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SEPTEMBER, 1943

The Economic Background to Post-War Agricultural Reconstruction

By

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The over-all aim of any rural "reconstruction" programme, it is here assumed, will be to produce a prosperous and happy agriculture, which is, at the same time, bent to serving the needs of the nation. This article is not concerned with the details of development. It aims to sketch in somewhat bold outline the background which is believed to be essential for reconstruction of our rural life.

If we want to find the real bases for post-war agricultural prosperity we must look elsewhere than in agriculture. The solution of this apparent paradox is found in the fact that modern agriculture is part only of a wider economy. One thing we must make up our minds to : there can be no solid and enduring prosperity for agriculture without prosperity for everyone. What, then, are the pillars of this new temple of economic well-being for all, at which we are all so eager to worship ? These pillars are three : world trade, full employment, adequate nutrition.

International Trade.

There can be no doubt that the key pillar in this structure is world trade. As we shall see, unless it is in place a large section of the third pillar could not even be built, while the second pillar could be properly built only with difficulty. I do not think one can find anywhere today greater unanimity of opinion on a major issue of policy than the unanimity found among economists, and indeed all students of international affairs, that prosperity for every *country* lies in having a *world* economy.

Stated in abstract theory, the reasons for this are obvious. They lie in the advantages of regional specialisation. Considered from the angle of the most economic use of world resources (a concept with which surely we are all familiar in this fourth year of war), it is just as absurd for England to grow her wheat, or Australia to make her motor cars, as it would be to set up tariff barriers on the roads which thread west from Sydney across the Great Divide.

If we are to achieve a New Order, we dare not deny the basic fact of differences between industries and between regions in the productivity of labour. For any of many reasons it is often true that in a given part of the world ten thousand workers can produce as much wealth in one industry as could be produced by fifty thousand in another; while elsewhere the position is reversed. It is, therefore, literally correct that by specialisation and exchange of products these two populations can be five times as well-off materially, as they would be if each were self-sufficient. Examples more extreme than this could be readily multiplied from the facts of economic life. The principle applies on an international scale in exactly the same way as in an intra-national economy. Fundamentally it is a question of the most effective use of the *world's* manpower. Men as producers are precious. This is a lesson we have re-discovered in war. If we are going, as a world, to use three Germans to produce the wheat which could be grown and carried across the ocean by one Australian or one Canadian, if we are going to use two Australians to produce a car which could be produced by one American, then we must be prepared to remain poor. And let us cease talking about New Orders.

This is no argument for a sudden return to free trade. It is an argument for the gradual, but systematic and continuous relaxation of every type of barrier to the international exchange of goods. *In the final analysis the standard of living of the world is equal to the average productivity per head of its working population.* A greater degree of international specialisation—"the bootmaker to his last"—is the most potent means at our disposal of quickly raising the average level of productivity.

I see no prospect for a prosperous agriculture unless the channels of trade are cleared. Unfortunately, almost everyone is prepared to give lip service to this principle, but there are few who do not quail or "carry out evasive action" when brought up against the particular implications which are unpalatable to them. At present we are blithely planning for a new order in which European countries will cease to grow uneconomic wheat. But are we prepared to plan away the Australian sugar industry or rice? If not, how are the Philipinos or Hawaiians to buy German machinery? And if they cannot, how is Germany to buy Australian wheat? We simply must face problems like this, if we wish to have a prosperous post-war agriculture. You cannot achieve prosperity by maintaining the *status quo* for everyone. Reconstruction implies give, as well as take.

It is true that the growing of much of Europe's wheat is uneconomic. It is equally true that large-scale reduction of the industry would involve serious temporary dislocation. Let us not see only the dislocation in our own case and the waste in the other fellow's case.

There is unfortunately a great deal of false optimism about, regarding the ease with which the international exchange of goods will be increased. What is not generally realised is that it will not be merely a question of improving the pre-war system. During the course of war every nation becomes less and less dependent on imports. Food importing countries expand their agriculture. Importers of manufactures expand their secondary industries. War twists economic structures powerfully. It sets up equally powerful groups—employers, wage-earners, investors, politicians—whose interest is vested in keeping them twisted. Before we commence to abolish the uneconomic production of peace time, we must tackle the uneconomic production of war time. In other words we start far behind the toe-line of 1939. The danger is that we may remain there—as we did after 1918. The "new order" rests on specialisation. War makes every nation a Jack-of-all-trades.

In brief, the economic development of the war period is in direct conflict with the needs of post-war prosperity. This is not cause for defeatism, it is certainly cause for sober realism which, interpreted in terms of action, means *planning*. Only a carefully thought-out plan for integrating all changes can rout vested interests. The longer the plan has for educating public opinion, the better the chance of success.

A Job for Everyone.

The second pillar of our temple is the maintenance of full employment. Unemployment means fewer goods produced. The volume of production is the real basis of the standard of living. The more of us who are producers, the more there is to share out among us as consumers. In the final resort people do not buy wheat, wool, butter, meat or fruit with money. They buy it with coal, steel, woollen clothing, moving people from place to place, teaching, wharf-labouring, building houses. The keeping of people in jobs is essential for the farmers' well-being.

Fortunately there are more grounds for optimism here. We now know why depressions occur. Fifteen years ago they came as a curse from some hidden hand. Here again there is a widespread measure of unanimity regarding a proposition which is now seen to be little more than common-sense. Depressions occur because spending power is not maintained. Spending power declines when private enterprise lowers the volume of *physical* investment for any reason—when fewer houses are built, fewer new factories constructed, fewer machines produced. If the government will but fill the breach and step-up public investment—development of irrigation, expansion of education system, reafforestation, construction of new roads—spending power can be increased again. The very fact of this increased spending power re-stimulates private investment.

Unfortunately, in the past the cry has always been for government economy at such times. Budget balancers seem to have forgotten that goods, not money, are the wealth of a nation. It is good economy to keep people at work. There is no reason, except lack of adequate planning, why we should not conquer unemployment after the war.

The economic significance of international trade and the economic significance of maintaining investment are both well understood. In the former case the immediate interests of many people clash with the policy of long-range benefit. In the latter case there is no such clash of interests. Opposition to public spending in a depression is likely to have about the same status in future as opposition to vivisection or "meddling" with nature.

We should not lose sight of the fact, however, that it will be far easier to maintain employment if we have a good export trade. Even if each country should keep its people at work, despite a high degree of economic autonomy, the world would be robbing itself of half the fruits of its toil.

Marrying Agriculture to Health.

We come now to the third pillar of our temple. In all countries productivity is seriously affected by the low level of health of considerable sections of the community. In some countries, such as India, it is impossible that productivity per head should ever be other than low, so long as the level of health remains what it is. The mere fact that the average length of life of an Indian is twenty-six years, whereas a human being's years of greatest contribution as a producer are from 20 to 60 is sufficiently striking proof of this. Poor health, resulting in actual sickness, chronic physical debility, early deaths and lowered mental activity, is the lot of the bulk of the world's population in all of Asia (except perhaps U.S.S.R.), most of non-Russian eastern and southern and south-eastern Europe, much of South America and among the depressed classes of western Europe, North America and Australia and New Zealand.

A world full of healthy, vigorous, bright people would mean an incalculable increase in the productivity per head of its 2,000 millions of population. The potentialities, taking the world as a whole, are probably far greater than those involved in getting everyone into a job. The new standard of living created would result in a very large increase in the demand for agricultural produce.

But this is not all. In the main the low standard of health of the bulk of the world's population is traceable, directly or indirectly, to lack of food. Here is the common interest which could make possible a successful "marriage of agriculture and health". This marriage, as we have seen, has a double significance for agriculture. Not only would the marriage ceremony provide agriculture (as well as the people of the world) with a new lease of life, but the marriage would produce a family—the family of greater production per worker—which would itself provide consumers for farmers' crops and livestock products. Hence our third pillar is particularly calculated to support agricultural industries. The very materials of which it is built are fashioned from agricultural products.

The co-existence of a half-fed people and agricultural potentialities straining at the leash is a fundamental fact about our current civilisation that should dominate our thinking. It should dominate our thinking about the agricultural problem, about humanitarian and social issues, about national income per head and about international trade policy. It is true that inadequate nutrition is partly due to ignorance of food values, but it is also true that given perfect knowledge of food values, the greater part of the population of the world would be undernourished at current (pre-war) rates of world food production. *The world of 1930-1939 was just not producing enough food to maintain its population at minimum standards of nutrition. It was also not producing sufficient fibres for minimum health standards of clothing.*

Some limited calculations have been made of the additional demand for agricultural produce which would be created by maintaining minimum and optimum standards of nutrition. Sir John Orr, in his *Food, Health and Income*, has calculated that, if food consumption in Great Britain were raised to an optimum standard (which is, after all, the standard for full health), the additional demand for food would be: milk 80%, butter 40%, eggs 55%, meat 50%, fruit 125% and vegetables 90%. Yet Great Britain is one of the wealthiest countries in the world. Another calculation shows equally vividly the significance for agriculture of adequate nutrition. If the people of Great Britain, France, Belgium and Italy alone were to drink the amount of milk accepted as desirable by the League of Nations Technical Commission on Health, an additional seven million dairy cows would be needed. (Australia has slightly over three million.) The implications for agriculture of an expansion of food consumption by the 2,000 millions of the world to even minimal standards staggers the imagination. So far no one has even attempted to make such a calculation. We don't need to.

I know that throughout this last page the hard-headed realist has been itching to intervene. How can the millions of Asia *buy* our wheat, let alone our meat, butter, fruit? They can't. I propose to *give* it to them. However, I do not propose that the farmers should give it to them. Peculiarly enough the very people (particularly in the United States) who speak witheringly of charity for the Hottentots have been the most ardent supporters for exporting as much as possible and importing as little as possible. What is this if not giving? The principal difference is that, instead of reaping the benefit in human welfare, it was secured in the form of tons of gold, buried in the hills of Kentucky.

Investing in Nutrition.

However, it is an understatement to describe such a policy as giving. It is a policy of investment. We do not hesitate to sink millions in railways, roads, irrigation schemes, improvement of farms, machinery, because we expect *future* production to be higher as a result. We have already accepted the principle of public investment in human beings in the policy of free education. We shall have no New Order unless we accept the principal of public investment in the nutrition of the people. This also cannot be left to *laissez-faire*—and for the same combination of

reasons. People do not sufficiently realise their responsibilities to themselves, and a large proportion cannot afford to pay for the investment. So far as most of the world's population is concerned, the *bulk* of the people cannot at present afford to invest adequately in their own nutrition. And yet there can be no doubt of the returns on the investment.

This analysis can be pushed further. Just as the wealthier countries have passed over from home investment in physical goods to foreign investment, so must the wealthier countries engage in foreign investment in human beings. When Britain built the railways of the Argentine she temporarily went without material wealth which could have been turned into goods for current consumption. She did this for three reasons: firstly, because she had a choice between "giving" this iron and steel to Argentine or not producing it at all, despite the fact that she had the productive capacity; secondly, because she anticipated that she would in this way build up Argentine as a cash customer in the future; thirdly, because she expected to secure a future *quid pro quo* as a result of her investment—a *quid pro quo* in terms of goods. Each of these reasons hold for foreign investment in nutrition. Unless we accept this principle we have the vicious circle that these countries cannot serve as markets because they are too poor and they are too poor because they don't eat enough. If we of Australia, North America and Britain will export food as a long-term foreign investment, we shall reap the benefit in breaking the vicious circle of poverty in three-quarters of the world's population and thus transform markets, as well as earn the gratitude of the masses of the world.

Here, then, are the programmes to which all agriculturalists—farmers and scientists—must subscribe. If we subscribe with success to the policies of Trade, Employment and Nutrition, there can be no doubt of the New Order for farmers.

However, the implications will bear further examination.

The Implications for Australian Farmers.

If production of food and fibres be based more and more on the best use of resources, considering the world economy as a whole, the greatest benefit would probably be reaped by Australia's basic export industries. Wheat, for instance, is a commodity on which more man-hours were wasted than on most products in a semi-crazy pre-war world. This was not because the wheat was not needed, but because it was not being produced in the best places. Australia is one of the best places, a country which can produce a large volume of wheat at as low a cost as anywhere else in the world. In a sane world a large part, possibly the bulk, of the wheat formerly grown in Europe would be produced in Australia, North America and Argentine. This is not a reason for trying to use precious *wartime* resources for building up post-war wheat stocks, nor for rushing needlessly into marginal areas or booming land values. Wool also would be found to benefit because Australia is a sensible place to grow wool. It is true that synthetic fibres have come to stay, but in a world enriched by free exchange of goods, there would be room for expansion of both synthetic and natural fibres. Of course each would tend to place a price ceiling on the other. This really means that we have a larger volume of resources to tap for meeting the clothing needs of the world, and no true humanitarian can regret the fact.

Meat, dairy products and fruit provide more doubtful cases. The natural rôle of Europe in agriculture lies in the production of protective foodstuffs. Furthermore, without a direct policy of raising nutritional standards, the consumption of meat, particularly, will remain very low in Europe for a long time. Finally, we must remember that Australia has had the advantage under the Ottawa agreement of very considerable protection against non-Empire protective foods. On the whole, I believe that Australia would benefit in respect of these industries from a policy of

freer international trade, even though nothing were done about either of our other two desiderata. It is, however, plain, from quite basic considerations, that the net outcome is not so evident. We should lose in Britain, gain on the Continent. The extent of the gain on the Continent of Europe depends largely on the level of consumption per head. Finally a few industries in Australia, of which sugar is the most notable, would undoubtedly suffer in a more competitive world.

Expansion of employment would chiefly benefit the producers of meat, eggs, dairy products, fruit and vegetables. These are the foods whose consumption is most susceptible to change according to variations in the standard of living. Low income countries consume very little of them at all. In the wealthier countries consumption per head rises rapidly as one moves up the income scale. There is an adequate research basis for these statements. Consequently if incomes are raised, demand for protective (or "luxury") foods will rise fairly rapidly and so will production. The demand for the basic energy foods (excepting butter, which is also a protective food) will not rise from an increase in income in *wealthier* countries. However social malaise does not, in the main, come out in the form of large-scale unemployment in the poorest countries, so a mere policy of maintaining full employment would have comparatively little effect on the world demand for basic energy foods.

The effect of an adequate nutrition policy would depend on the standard of living of the country concerned. In Australia, England, part of pre-war western Europe, North America, and probably parts of South America, investment in better feeding would mean more protective foods. On the other hand in most of Asia and large parts of eastern and southern Europe the first necessity is to alleviate hunger. This means, above all, wheat. It also means rice, sugar, potatoes. However, a programme for abolishing starvation in Asia would need to be expanded into a policy of a balanced diet. In many parts of the world, including much of Europe and South America, the need would be almost equally for energy and protective foods.

In summary our three programmes, considered as an entity, bear their gifts for all farmers who are not engaged in production which conflicts with the principles of a sane world. Even for such men planned replacement would not be difficult.

Let us hope, however, that we have learned the lesson of the 1930's. Restriction of output and artificial prices are the enemies of agriculture in the long run, as well as the foes of mankind. We can no more achieve prosperity for agriculture by propounding measures, aimed directly at agricultural benefit without regard to their wider effects, than we can achieve happiness by chasing pleasure. Happiness is a by-product of worth-while activity. Agricultural prosperity is a by-product of worth-while world economic and social activity.

(Received for publication, 12th May, 1943.)

Centenary of the Invention of the Stripper

Mr. Ridley is entitled not only to the honour of independent discovery, but to the highest merit for his unwearied diligence, patience, skill and enterprise in constructing and carrying into effective operation one of the most important machines which has ever been used for the benefit of agriculture and of mankind. (Editorial in Southern Australian, November 19, 1845.)

John Ridley, the man who invented, constructed and developed commercially the "Stripper", the machine which replaced sickle and scythe for directly harvesting fields of standing wheat, was born at West Bolden in County Durham, England, on the 26th May, 1806, and left for South Australia in November, 1839, where he arrived in 1840.



John Ridley.

He brought to the country its first steam engine, which he used for grinding wheat at the flour mill which he erected at Hindmarsh. It was the first mill to be operated in the new settlement of South Australia.

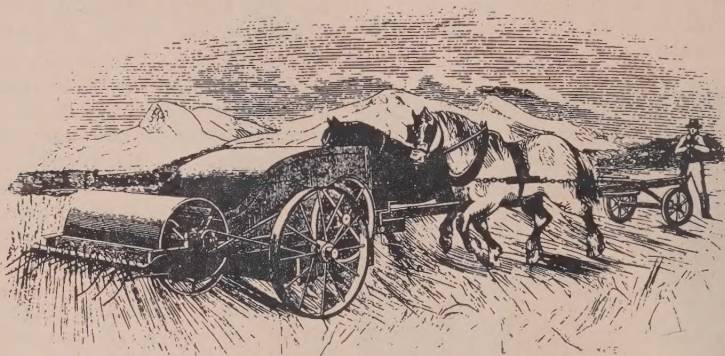
The close association of the flour-miller with the wheatgrowers of the infant colony impressed upon the mechanically-minded Ridley the urgent necessity of machinery for harvesting the crops, if wheat growing was to be developed to the extent to which the climatic conditions of this new country appeared to indicate. This development was, however, being severely handicapped because suitable manual labour was very short for practically all purposes. His thoughts in this direction were influenced by a sketch accompanying an article dealing with the earliest recorded reaping of wheat by machinery which appeared in Loudon's *Encyclopædia of Agriculture*, referring to a machine which was reputed to have been operated in Gaul in the time of Julius Caesar.

The investigations and trials made by John Ridley culminated, towards the end of 1843, in a machine which successfully harvested the grain and chaff of ripe wheat crops, leaving all else standing in the field, the machine becoming famous in a very short period of time under the name of the "Stripper".

The principle of the Stripper, viz. the stripping of the grain and chaff from the heads of standing crops, was embodied in all cereal-harvesting machines until the first decade of the twentieth century, when the knife-bar and threshing drum were introduced in a complete harvesting machine constructed by Massey, Harris Pty. Ltd. of Canada. Not only was the Stripper system of harvesting wheat and other cereals the predominating principle for 75 years of all machinery capable of harvesting cereal crops which reach full maturity in the field, but a considerable proportion

of present-day crops is still harvested in Australia with machines of this character, and even now, 100 years after the first machine was successfully operated in the field, scores of new Strippers are manufactured each year, and the main features incorporated in Ridley's machine are still utilised and have not been changed much from the original forms adopted in the first machine put on the market by the inventor and manufacturer away back in 1843.

It is quite impossible to express the effect upon the wheat industry of Australia in £ s. d. of the rapid development of the Stripper, but the revolution, which was brought about by the achievement and sudden introduction of such a machine at a harvest time when suitable labour was so short that it was generally recognised that crops could not be properly collected, can readily be imagined.



The Original Machine.

—From *South Australia and its Mines*, by F. Dutton.

The outstanding success of the machine was such that Ridley was immediately pressed to manufacture several similar machines, which he did as fast as materials and mechanics became available, and, by the time he returned to England in 1853, he had the satisfaction of having seen a tremendous increase in the area sown to wheat, which was made possible by the introduction of such an effective harvesting machine, and, as several other mechanics were by then manufacturing "Strippers" to the pattern evolved by him, he knew also that the harvesting of the increased acreages was being adequately catered for.

Ridley did not patent his Stripper and, although he manufactured and sold several of the machines before others undertook the production of them, it was generally recognised that he made little or no profit from his enterprise in this direction.

A public benefactor of exceptional merit was John Ridley, who, 100 years ago, by the invention and construction of a machine given freely to the world without patent rights, brightened the future of agricultural settlers in Australia, led to the rapid acceleration of the wheat growing industry of this young country and quickened the inventive genius of agricultural machinery mechanics.

W. J. SPAFFORD.

(Received for publication, 9th August, 1943.)

Post-War Rural Reconstruction

REPORT OF THE QUEENSLAND BRANCH.

Considering the subject of post-war rural reconstruction in Queensland, members of the Branch have recognized that one of the biggest national problems in the immediate post-war period will be to find gainful and useful employment for a vast number of discharged and demobilized servicemen and workers in war industries until such time as each can be re-absorbed or placed in a normal peace-time occupation. This, of course, will necessitate an extensive programme of public works. The importance of the rural industries in the Australian economy demands that projects for the development of these industries and the conservation of the natural resources of the country should figure largely in post-war public works. Prospective avenues for the employment of large numbers of people in rural public works have been examined and recommendations regarding them appear in several parts of this report.

In addition to the temporary employment of men on projects related to agricultural development and conservation, the permanent absorption of people in land industries has been considered. The view is taken that further land settlement is justified only when efficient use of the land is assured, and this depends upon such desiderata as suitability as to fertility, topography and accessibility and an unsaturated market for the produce of the land.

The other chief concern of the Branch has been consideration of measures for the sound development of the rural industries in Queensland. The ultimate aim of agricultural policy should be the stability of primary industries. In the interests of stability, the development of those industries should proceed along the lines of increasing the efficiency of production rather than of mere expansion of the area under crop. Additional stabilizing factors are represented by orderly and efficient distribution and marketing of farm products, and some attention has been given to these.

In developing its ideas on post-war agriculture, the Branch has repeatedly been faced with the fact that a greater degree of governmental control of land to prevent its misuse is desirable. The occupier of land should be regarded as holding the land in trust for the nation, and governments, therefore, should exercise more rigid control of land to prevent abuse of that trust. It is held, also, that hand-in-hand with firm legislative control should go a larger measure of government financial responsibility for the conservation and development of the land. This point of view is reflected in many of the recommendations made in this report.

Branch recommendations relating to land settlement, post-war rural public-works undertakings, and efficiency of the rural industries are embodied in the statements which follow.

Land Settlement.

It is the opinion of the Branch that it would be wrong to encourage the settlement of a large number of people on the land and permit them to engage indiscriminately in the production of crops for which there is not an assured profitable market. In the case of most primary products, stability of the industry depends largely upon increasing the efficiency of production on existing farms. In this connection it must be noted that *per capita* production of most products is actually increasing, due to the extra efficiency resulting from advances in machinery and improved methods of production.

The view is held, therefore, that any scheme to settle people on the land should be so designed that the Crown may stipulate that only products for which there is an assured market may be grown on that land. Only in this way can the unsettling influence of further over-production on already unstable industries be averted and the new settlers themselves assured of participation in a stabilized industry. Advantage could be taken of this form of crop control to provide the nucleus of a zoning system whereby crop production within a specified district is controlled and the distribution of the primary products of the district directed to the best advantage.

The matter of land settlement in Queensland has been viewed by the Branch particularly from the point of view of absorption of some ex-servicemen in primary industries. The general conditions under which it is considered land should be made available for settlement are as stated above, but it is considered further that, in all cases where ex-servicemen are being placed on the land, special attention should be given to the agricultural training of prospective farmers, the suitability of the land, and the partial development of holdings prior to occupation. These are considered to be outstanding points and have, therefore, been given more detailed attention.

Agricultural Training of Prospective Farmers. Successful land-settlement schemes depend not only on the choice of suitable locations for farms, but also on the suitability of the men themselves for efficient management. Many of the failures of the past have been due to the attitude that farming is an occupation which can be undertaken by inexperienced men, or even by those who are unfit for any other type of employment. While there is always scope for unskilled rural labour, the successful management of a farm calls for considerable aptitude and knowledge of the job. The unskilled man is likely to be forced off his holding, impoverished and disillusioned, before he has learned his trade by hard experience, and the man who is temperamentally unsuited to such work may never become efficient. Apart from the human problem, it must be remembered that the soil is a national asset which can be frittered away by misuse.

The men who will favourably consider settling on the land will include those with previous farming experience who will go back to the same type of farming, those with experience who wish to undertake some other type of farming with which they are not familiar, and those who have had little or no experience of agriculture. The last group will include many who have gone into the fighting services at an early age and have had no opportunity of learning the job. For these, and the second group, some training scheme will be essential, and in the case of inexperienced men it will be necessary to have some method of sifting out those capable of making a success of their own farms from those who, though valuable as farm workers, are not fitted for the management of a property.

The agricultural education of men, who during their years of training in the fighting services have lost the faculty of studying or of benefiting fully from short instructional courses, is not an easy task. The State Agricultural College and, perhaps, certain field stations of the Department of Agriculture and Stock, might undertake such courses for those with previous farming experience; these would be essentially refresher courses and, in some cases, courses designed for farmers embarking on a type of farming different from that to which they were formerly accustomed.

A scheme by which training could be effected with reasonable efficiency, and which would not only provide the men with sustenance during that period but would assist in post-war agricultural production at the same time, might be termed the Farm Apprenticeship Scheme. It has the important advantage that it would be a means of sifting out those capable of going on to their own farms from those whose standard is that of farm employees. In essence, it consists of the indenture of men

to approved farmers—that is, farmers who have successfully applied up-to-date methods on their own holdings—the period of training, at a nominal wage, perhaps supplemented from governmental sources, being one year. In a year the cycle of farming operations would be seen at first-hand and the trainee would have first-hand practical experience of the whole of the work. By the end of that period, or perhaps earlier, those who are unsuited to such a life would have realized, in most cases, the difficulties in their way and either drop out or decide to continue as employees. In any case, these men would not have had the expensive and disappointing experience of fighting a losing battle on farms which they were incapable of working efficiently. It might be that some would prefer a longer period of employment before finally deciding on an independent farming life.

This Farm Apprenticeship Scheme would further enable a man to concentrate on his chosen type of farming, e.g. a prospective orchardist could be assigned to an approved grower in the Stanthorpe district. If new areas are to be opened up for settlement, say in northern Queensland, the apprenticeship year should be spent in areas where a similar type of agriculture is practised. It is not necessary, though preferable, for a man to be trained in the district in which he is to farm.

Whatever the merits of a short training course at an agricultural college, it must have the following defects:

- (a) it cannot, from its location, deal with all types of farming;
- (b) a short course cannot show a trainee the seasonal aspects of farm work;
- (c) individual tuition is not practicable with large classes;
- (d) there is little opportunity to gauge the potentialities of the trainee.

After settlement on his holding, the new farmer will inevitably be in need of further guidance from time to time, and an efficient extension service from the Department of Agriculture and Stock will be necessary. This might be provided by the establishment of a departmental body similar to the Agricultural Bureaux of South Australia and New South Wales.

Suitability of Land. It should be obvious that no block of land should be thrown open for settlement unless it has been examined by competent authorities and declared to be suitable for agricultural or related pursuits. The Branch goes further, however, and recommends that no land be made available for settlement unless it is passed as suitable for the economic production of one or more of a restricted range of primary products, such products to be those for which a market is assured.

Partial Development of Holdings. It is to the benefit of the nation, as well as being due to ex-servicemen, that new land thrown open for settlement should return a living to the settler within a very short time of being taken over. To this end it is recommended that consideration be given to the partial development of new farms at the expense of the State Government, as landlord, and/or the Commonwealth Government as repatriating authority. In addition to ensuring early independence to the settler, such a system would provide useful temporary employment for large numbers, as men would be required for clearing lands, erecting buildings, constructing dams or sinking wells, installing mechanical means of soil conservation where required, and providing access roads to the farms.

Soil Conservation.

Although this matter is dealt with in the main as a post-war public-works engineering project, it is stressed that, broadly speaking, soil erosion results from incorrect use of land, and soil conservation is, consequently, largely a matter of good farming. With this in mind, the Branch has decided that the major prerequisites to soil conservation are (a) an educational campaign to teach landholders proper soil-management practices, and (b) further legislation by governments to prevent land deterioration due to improper methods of management and utilization.

With regard to the educational campaign, it is considered that sufficient reliable information is available for the groundwork, although it is realized that much remains to be done in ascertaining the most efficient methods of land utilization under various conditions.

The measures which it is contemplated should be enacted to prevent land deterioration are an extension of recent amendments to the Queensland Lands Acts, whereby no owner or occupier of land is permitted, without authority, to ringbark, cut down, fell or destroy any tree within 44 yards of a watercourse.

Mechanical methods of soil-erosion control are complementary to proper soil-management practices, and the problem of demobilization of the Australian armed forces in an orderly manner, together with the presence of a large amount of earth-moving equipment in this State, provide an outstanding opportunity to embark on a comprehensive scheme of soil conservation. Operations of an engineering nature are required in general farming areas, in vegetable-growing areas, on horticultural lands, on pastoral holdings, on road areas and along watercourses.

The major work in any engineering scheme would probably be carried out on the Darling Downs and in the more inland sections of the Moreton, Wide Bay and Port Curtis Divisions. The types of soil occurring and the normal rainfall experienced make most of this area suitable for the application of soil-conservation principles adapted to similar conditions in the United States of America. The broad-based terrace undoubtedly could be used to advantage for controlling both gullying and sheet erosion in those districts.

In the wetter portions of the Moreton, Wide Bay and Port Curtis Divisions and of more northern Divisions abutting on the east coast, the occurrence of extremely heavy tropical storms requires that considerable investigational work be carried out on the various soil types before any large-scale scheme of mechanical treatment could be safely undertaken. However, useful work could be done in providing diversion ditches and drainage in these coastal areas until reliable information is obtained on the best methods to apply to the cultivated land itself.

The Branch is of the opinion that work of the nature outlined above should be undertaken as a post-war public-works project. The cost would, of course, be borne in the first instance by the Crown, and it is felt that the Crown, as landlord, should not pass on any great portion of the cost to lessees of Crown land. Further, it would be in the Crown's interests to assist soil-conservation work on freehold lands by granting subsidies and loans under liberal terms. However, the Branch holds that assistance should be given by governments only where landholders bind themselves, or are required by legislation, to follow approved farming practices.

As was pointed out in the initial paragraph of this section, soil conservation is primary an agronomic problem rather than an engineering one; hence, it is strongly recommended that no work under the proposed scheme should be undertaken unless approved by the Department of Agriculture and Stock.

The implementation of a large-scale soil-conservation scheme would require the employment of a large number of soil-conservation specialists. The number of adequately trained men in Australia is extremely small, and, if a post-war scheme is approved, immediate action would need to be taken to train the additional directional personnel required.

Water Conservation.

The incidence of rainfall in practically all the agricultural areas of the State is such that wide fluctuations in production are a feature of most primary industries. The only stabilizing force in this connection is irrigation, and it is not too much to say that irrigation is essential to efficient production in most parts of the State.

Numerous proposals for the development of agricultural lands by irrigation have been made at various times. Most of these have been investigated from the water-supply point of view by the State Sub-department of Irrigation and Water Supply. The main streams surveyed in recent years are as follows :

- (1) Dumaresq or Severn River—water-conservation scheme of interstate application, mainly for tobacco growing ;
- (2) Macintyre Brook—tobacco, cotton and forage crops in the Inglewood district ;
- (3) Balonne-Condamine Rivers—storage schemes for cotton, forage and other agricultural crops ;
- (4) Reynold's Creek—storage dam to serve portion of the West Moreton cotton, maize, potatoes, onion, pumpkin and lucerne district ;
- (5) Lockyer Creek—weirs for cotton, lucerne, potatoes, maize, onions, and pumpkins ;
- (6) Barker's Creek and Barambah Creek—weirs for cotton, maize, lucerne and truck crops ;
- (7) Burnett River—survey of main stream for storage purposes for cotton, citrus, truck crops, cane ; weirs for cotton on Monal, Three Moon and Splinter Creeks ;
- (8) Dawson River—weirs for cotton, lucerne, truck crops ;
- (9) Burdekin River—storage in middle reaches for fruit, truck crops, tobacco ;
- (10) Emerald Creek and Walsh Rivers—storage for tobacco.

In addition, surveys for the development of underground supplies have been carried out at various places, including Forsayth (tobacco), Gumlu (truck crops) and Callide Valley (cotton).

It is noticeable that many of the irrigation projects are related to cotton and tobacco growing, both crops for which there is an assured Australian market.

A good deal of country contiguous to the streams listed, as well as to certain other streams, is already devoted to agriculture and the provision of irrigation facilities ensuring cheap water would certainly increase the efficiency of production of these developed lands. There is, in addition, a good deal of undeveloped country adjacent to streams which appears to be suitable for some form of agriculture, although as yet few detailed soil surveys have been made.

There is no doubt that, if cheap water is available, the efficiency of agriculture in many of our rural areas would be considerably increased. If we consider the ten streams listed and provide for an average of eight weirs on each at an average cost of £10,000, a total expenditure of £800,000 would be necessary for the 80 weirs. A large proportion of the cost would be for labour, and it is suggested that this form of work would provide a useful means of utilizing the services of a large number of ex-servicemen during the immediate post-war period.

Finance and labour might also be made available for utilization of underground-water supplies and for the construction of earthen tanks.

The Branch is definitely of the opinion that no irrigation project should be undertaken unless a prior examination by specialist agriculturists has indicated that the area proposed to be served has sufficient agricultural possibilities, from both the agronomic and economic aspects, to warrant the work.

Distribution and Marketing.

The stability and the expansion of production of many perishable products depends upon the development of processing plants and improvements in transport.

In order to permit the planned development of the truck-crop and certain fruit industries, it is essential that early attention be given to the erection of canneries and other processing plants in appropriate districts. It is necessary, in the case of

perishables particularly, that processing plants be close to the producing farms, and a survey to determine the best sites in existing and potential areas of production is called for immediately.

So far as the fresh fruit and vegetable markets of the State are concerned, there is need for more rapid methods of transport and for a vast improvement in the carrying conditions, especially in refrigeration facilities.

Efficiency of Production Methods.

It has been stressed earlier in this report that agricultural stability depends largely upon increasing the efficiency of production. Many of the problems of efficient production, e.g. those relating to cultural methods, varietal improvement, pest and disease control, etc., are being handled more or less adequately by State bodies and there is every reason to believe that the post-war period will see an intensification of this work. There are, however, certain factors which conduce to inefficient farming and which might be considered as problems requiring, or at least meriting, action on a national basis. Among these are (1) costs of lime and fertilizers; (2) standardization of certain farm implement parts; and (3) weed control.

Costs of Lime and Fertilizers. The acid condition of the soils of practically the whole of the coastal strip of Queensland is a deterrent to the growth of some crops and to pasture development. The remedy for this condition is liming, and often heavy liming. The usual recommendation—and this is on the conservative side—is to use between 1 ton and 2 tons of lime (CaCO_3) per acre every few years. In most of the agricultural and dairying districts it is impossible to land lime on the farm at less than £2 10s. per ton. This means a cost of £2 10s. to £5 per acre each five years or so for soil amendment purposes, which is more than the farmer can afford to pay. The average cost ex works in New Zealand is 11s. to 15s. per ton, with free railage up to 100 miles.

The main sources of lime are Gore, Tamaree, Ambrose and Chillagoe. Apart from the investigation of possible sources of supply in the districts requiring lime, governments may be able to assist by reduced railage freights on lime and by granting a subsidy on all lime used for agricultural purposes.

Even in normal times the costs of fertilizer imported to Queensland are extremely high when compared with costs in New South Wales, and some action to reduce the net cost to the farmer is required. This may be effected, of course, if superphosphate is manufactured in Queensland after the war, but even then there may be need for a subsidy, and possibly for a differential subsidy to make the net cost to the Queensland farmer approximate that to farmers in States where the gross cost is appreciably lower.

Standardization of Implement Parts. It is understood that the Standards Association of Australia has carried out investigational work on the standardization of attachment of wearing parts of farm implements and on other matters relating to farm implements and machinery. The importance of this work is appreciated by the Branch and it is considered that universal adoption of the standards set by the Association in these matters would help considerably in increasing the efficiency of crop production. It is, therefore, suggested that the recommendations of the Standards Association on matters relating to farm implements and machinery should be implemented by legislation.

Weed Control. Farm and pasture weeds are a first-order menace to the agricultural and pastoral prosperity of Queensland. Each year witnesses the spread of common weeds from district to district and usually a fresh name added to the long list of noxious weeds occurring in the State.

There is need for a positive policy on weed control, instead of relying upon the *Government Gazette* as a panacea for weed ills. Undoubtedly, much weed trouble is

attributable to depletion of soil fertility and to improper methods of pasture management, and basically the cure lies in rehabilitating run-down country by improved soil- and pasture-management practices. These, however, have not yet been elaborated in detail and the need for palliatives to weed troubles remains.

There are three means by which governmental authorities may assist landholders in weed control, viz. :

- (a) Provision of cheaper, reasonably safe weed killers : The Queensland Government supplies arsenic pentoxide at a cheap rate, but arsenicals are so dangerous to livestock that there are large areas on which they cannot be used. Cheap chlorate weedicides would be of considerable benefit.
- (b) Eradication of "reservoirs" of weeds by employing weed-killing gangs : Normally, the eradication of large infestations is the responsibility of the local authority or the landholder, but it is seldom undertaken because of the expense involved. Here, again, it is recommended that ex-servicemen be employed, with the main expenditure on labour. (This system operates in South Africa, where the government undertakes weed destruction to the point where the landholder can reasonably be expected to cope with the pest himself.) The holders of land benefited by Crown expenditure on work of this nature should, of course, be required to maintain control on their properties once the infestation is reduced.
- (c) Clearing of sucker- and seedling-infested country : The sucker and seedling problem is one of considerable magnitude in Queensland, large areas of partially cleared country having been virtually abandoned to suckers and seedlings, thus reducing the productive capacity of crop and stock farms and pastoral holdings. It is considered that, with so much heavy land equipment in the State, an attempt should be made to restore much of the affected country during the post-war period. The suggestion is made that machines at present being used in the construction of airfields, etc., could be adapted to remove suckers and seedlings and destroy them. If undertaken as a public-works project, this scheme should be restricted to good agricultural or pastoral land, the holders of which bind themselves to practise approved methods of utilization to preserve the land in its improved condition.

Agricultural Aspects of Reforestation.

Various aspects of reforestation concern the agricultural interests of the State. There are, for example, such matters as proper allocation of land as between forestry and agriculture, reforestation for soil-erosion control and prevention of siltation, grazing of forest reserves, provision for farm requirements, and so on.

The interests of agriculture are of sufficient magnitude to warrant representation of the agricultural industries on any body set up to develop forestry.

In its review of avenues for employment of demobilized servicemen in developing agriculture, the Branch has concluded that, during the post-war period, attention should be given to reforestation for soil-erosion control and for the prevention of siltation of streams.

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Agricultural Production Costs

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Interest in the cost-and-price relationships of agricultural commodities has been greatly stimulated by the war. It is likely to increase in the immediate post-war years particularly if production should continue on the basis of government-supported prices announced in advance. Cost of production investigations might become popular, as they did in the U.S.A. during and immediately after the last war. As some members of the Institute will no doubt be associated with investigations of this type it may be worth while to examine briefly, in the light of experience elsewhere, the difficulties associated with the carrying out of these studies and the usefulness of the information which they provide.

Historical Development.

The systematic investigation of farm accounts by a central organization originated in Germany in 1872, the information so obtained being used as an aid to farm management. Interest in farm accountancy developed rapidly, particularly in the years following the 1914-18 war when taxation legislation became particularly complicated. By 1926 there were some 500 officers and branch offices scattered through Germany dealing solely with farm book-keeping.

Farm-cost studies were commenced in Denmark, Switzerland and the U.S.A. between 20 and 30 years after they started in Germany. In 1902 a study of costs on a group of farms was begun under the supervision of the University of Minnesota. It is regarded as the first of its kind in the U.S.A., the country where most has been done in subsequent years in developing the technique of farm-cost investigations. However, it was not until after the war that the method of investigating farm costs through the keeping of records became widely used. It had the merit of greater accuracy than either of the other methods, i.e. by estimation or by means of surveys, but it was slow and costly. The survey method, which entailed the systematic questioning of large numbers of farmers, few of whom might keep detailed records of their activities, was the more popular. It allowed larger samples to be studied, and required less time. The greater inaccuracy of the individual observation was offset by the increase in the size of the sample.

In 1919 and 1920 cost of production studies constituted the bulk of agricultural economic investigations in the U.S.A. Usually their primary aim was to provide a basis for price fixation. Considerable time and effort was expended on them, but as experience increased it was found that monetary "costs" were highly disappointing. A great deal of severe criticism was levelled at the studies, so much so that frequently much of the good in them was overlooked. After reviewing the history of cost of production studies in the U.S.A. Bennett concludes that "Cost statistics are in fact useless in providing a 'scientific' basis for the fixation of market price". Although they proved far from satisfactory for purposes of price fixation, the studies provided a lot of very useful information about the industries with which they dealt. Real costs in terms of labour, feed and other materials were found highly useful in planning the operation of the individual farm as well as in examining variations in efficiency on different farms.

Difficulties in Procedure and Interpretation.

We need not concern ourselves here with the theoretical objection that a "fair" price is not necessarily one which covers costs of production, but will pass on to consider the practical difficulties encountered in trying to obtain reliable figures for production costs.

One of the chief grounds for criticism of farm cost figures, no matter which of the recognized methods is used to obtain them, is that they do not represent a true sample of the population about which information is sought. If a random selection is made, it will be found almost invariably that a proportion of the people approached will be unable or unwilling to supply the required information. Anyone who has had experience in the making of almost any type of farm survey will readily appreciate this point. The investigator is then forced to rely on a sample drawn from those who are able and willing to assist, and who nearly always prove to be the better-than-average farmers. Thus the sample is biased and it is not possible to measure the degree of bias. Admittedly this may not be so serious as it sounds provided the investigator is thoroughly familiar with conditions throughout the industry and it is he who is responsible for interpreting the figure he obtains, which of course is not always the case.

The next difficulty lies in determining certain of the elements of cost and, for mixed farms, in allocating them between the various products. What rates should be charged for family labour, for horse labour and for depreciation on machinery and how should these and other charges be divided between enterprises on a farm which produces say milk, fat stock, apples and potatoes? Problems of this nature are insoluble on any generally satisfactory basis. The arbitrary procedures which have to be adopted in consequence limit the value of the figures.

What are allowable as costs? Ought rent of land to be included as a cost? Many economists will argue that it should not, on the grounds that it is the value of production which determines rent.

When figures have been determined for a series of farms over several years it will be found that they vary widely between farms and even on the same farm in different years. In these circumstances the limitations of a single, average cost of production figure can be appreciated. The so-called "bulk-line" theory was formulated in an attempt to overcome the difficulties associated with the choice of one cost figure from an array covering a wide range. The bulk-line cost is the cost below which the majority of the producers, usually 85 per cent. is taken, operate. The theory has been widely criticised and appears to have been little used as a basis for price fixation.

If collected over a period of sufficient length to smooth out the effect of seasonal fluctuations there is a risk that the information will be out of date. The cost-price relationship is essentially dynamic and a change in production technique, for example, can invalidate data relating to a previous period. This criticism would be particularly apt in war time. Information about what it cost to produce a crop last year may not necessarily provide sufficient data for determining the price it will be necessary to offer to bring about the required amount of production in a future period. Costs may change or other lines of production may become relatively more profitable, or there may be physical limitations to increased production in the shape of shortages of labour, fertilizer or machinery whose effects cannot be measured in terms of money.

Another defect of the "average" cost of production as a basis for price fixation is that it neglects the seasonal variations which may occur when crops are raised throughout the year, e.g. milk, vegetables. Producers will, where possible, concentrate on production during the most favourable part of the season for they will not have the incentive of high "scarcity" prices to tempt them to grow out-of-season crops. This is a difficulty which has been experienced in the potato growing

industry in Western Australia. Potatoes are usually short in September and October. The crop which matures about this time is an uncertain one with higher costs of production than the crops harvested in the summer months. The price fixed for potatoes is insufficient to encourage increased production at the earlier period, but it is high enough to result in an over supply from the irrigation areas in the late summer.

Practical Considerations.

Despite the many deficiencies of cost of production data as a basis for price fixation it is by no means improbable that investigations for this purpose will be made in some agricultural industries in Australia. When action of some sort is imperative it is better to have a little information to work on than none. If the studies can be designed to measure changes in costs over periods of time rather than absolute costs they will be of considerable assistance to price controllers. No doubt also, it will be expedient to procure the most reliable figures available in order to satisfy the parties concerned that adequate investigations have been made.

When investigations are carried out in different States, the need for some degree of uniformity in making the unavoidable arbitrary decisions referred to earlier is obvious. The necessity for very careful planning of the work is probably not so clear to those who have had no experience in this field. A small error in the framing of questionnaires, for example, may result in failure to obtain information on an important point. An instance of how neglect of detail can reduce the value of an investigation was afforded in a recent statistical enquiry. In one column of the form, farmers were asked to record the number of milking stands (not machines) on their property, and in another the number of engines. No directions were given as to whether engines used solely with milking machines were to be listed in the second column. It is likely that some were and some were not, and at the conclusion of the investigation it would not be possible to provide any accurate information concerning the numbers of either machines or engines.

No matter how much care is taken in the initial planning, practical experience will generally indicate that improvement can be made. For this reason it is usually preferable to commence the work on a relatively small scale and extend it as experience is gained.

For whatever reason cost-of-production studies may be undertaken, they can be so designed as to yield a great deal of useful and badly needed information about the economic structure of our agricultural industries.

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Science and a Better Way of Life for Farmers*

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The Scientific Attitude.

William Farrer was a man of broad vision and wide interests. His approach to either technical or social problems would have been that of the true scientist—one, that is, of careful observation and experimentation, and the accumulation of facts interpreted impartially and disinterestedly. This approach led him to believe that the major problem of wheat-growing during his lifetime, namely that of securing better and more rust resistant varieties, could only be solved by the tedious process of intercrossing followed by years of selection. The results Farrer obtained vindicated the use of the scientific method which he used. This and similar achievements in the realm of technical science have raised enormously the productive capacity of the land. It is doubtful whether the advance made possible by the application of technical knowledge to agriculture has added as much as it should to the material, social or spiritual progress of the farming community. Is this not due to failure, up to the present, to use the scientific method of approach to the economic and social problems with which agriculture is confronted?

Perhaps it was natural and right that most of the attention of scientific thinkers should earlier have been focussed on the solution of the technical problems of production, but the history of Australian agriculture, at least during and since the first world war, has surely moved the emphasis on to the difficulties associated with orderly marketing, efficient farm organisation and the planning of agricultural production. These problems, too, are surely capable of solution by using the methods of science. For science is but "common sense of the highest order" and differing "from the common sense of daily life in that it is completely freed from the influence of emotion, and is subject to the rigorous control of observation, experimentation and precise thought" (Nicholson, A. J., *J. Aust. Inst. Agric. Sci.*, 1: 18-21, 1935).

It is true, of course, that trained scientific workers have not a monopoly of the scientific method of thinking and that they are often unable to apply the same clear and impartial methods to the analysis of their personal and social problems as they try to employ in their technical researches. As biologists, chemists and physicists, scientists make careful observations and conduct well-designed experiments. All the results are then clearly and disinterestedly interpreted in a spirit of impartiality and scientific honesty. If the results are not as expected, other experiments are designed to find out why, since to ignore a negative result would be dishonest. Admittedly such branches of sciences are more exact than those, for example, concerned with international trade, social reconstruction or farm management. But the method used in their solution should be similar if there is to be a well-organised and progressive rural community and a "better way of life for farmers".

Science and Technical Progress.

Having considered briefly the meaning of science and the scientific method, we may pass on to review something of the rôle science has played and may yet play, in the history of agriculture in its various facets. The early history of farming is the history of the growth of civilization. When the Egyptians commenced to cultivate

* The Farrer Memorial Oration for 1943, delivered at the twentieth Annual State Conference of the Agricultural Bureau of New South Wales, 14th July, 1943.

the date palm and the Chaldees their primitive cereals, their towns became centres of culture and progress. Later the "glory that was Greece" was closely associated with that phase of Greek culture which sought to find an explanation of the living things on which its progress depended. The philosophy of Socrates, Plato, Aristotle and Theophrastus was the philosophy of living things. It at least sought to explain natural phenomena in relationship to the problems of everyday life. Those who succeeded them erred in believing that science consisted only in a study of the works of these philosophers. Their attitude led to the scientific and intellectual stagnation of the "dark" ages. It was the challenge of men like Roger Bacon to this attitude of mind which brought light and progress. The "creative minority" which dared to challenge accepted beliefs was both ignored and persecuted. But those who followed the light of independent experiment and thought could not be turned back. Today as in the past, "how few think well of the thinking few, and how few think, who think they do".

Amongst the recent contributions of technical science to agriculture should be considered the greatly increased mechanisation of our larger farms, the use of artificial fertilisers, the principles of soil management and the control of pests and diseases. Mechanisation alone has allowed a modern wheat-grower in less than an hour to harvest an acre of a twenty-bushel wheat crop where it would have taken his grandfather a week of heavy toil with the sickle and flail to achieve the same result. It is less than a century ago that an epidemic of Irish Blight in potatoes precipitated a famine and a revolution in Ireland. It was as recently as 1861 that de Bary showed, as the result of careful researches, that this plant disease in common with others did not, as was previously assumed, spring spontaneously from the sap of the growing plant, but that it was in reality the result of a fungus attacking it from outside, and then only when moisture and temperature conditions were favourable. It was later the recognition of a happy accident which led to the use of bluestone sprays for the control of this blight and eventually to its successful application at intervals suggested by the life history of the parasite. Plant breeders, following the lead given by Farrer himself in breeding for disease resistance, are only now demonstrating how an easier and better method of control is possible, through the release of late blight resistant varieties such as Sebago and a number of unnamed hybrids with the wild *Solanum demissum* plants collected in Mexico.

Science and Plant Improvement.

Because of Australia's great debt to the pioneer wheat breeder, William Farrer, it is appropriate to direct the spotlight especially on achievements in plant improvement—"the oldest of arts but the newest of sciences". We will glance only at the work of the wheat breeders Carleton, Saunders, Farrer and Hayes.

As a student at the Kansas Experiment Station, Carleton had seen the mid-western American farmers, with high hopes, plant in the autumn the wheats which during the winter or early spring would often be killed out completely by the intense cold. Many farmers left in despair, but not all, for a few Russian Mennonites, he found, had not been frozen out by the winter killing of their wheat crops. They had brought a few pounds of wheat seed with them from the Russian Steppes. He put seed from their crops alongside that being used by the men who were being driven from their farms. The seed from the Russians survived, that from the other men's fields died. Carleton studied the map of Russia. He saw its climatic and geographic similarity to North America and eventually, and in spite of the opposition of Washington officialdom, Carleton collected hundreds of samples of both winter and durum wheats from the fields of the Russian peasants. Within a few years over twenty million acres of these hard red winter wheats were being sown on the Great Plains of the United States and mostly with the varieties distributed by Carleton.

His Russian Kubanka wheat, also, became the standard of excellence for American macaroni manufacture.

A thousand miles further north on the Canadian prairies the problem was different. It was the early autumn frosts which destroyed the wheats as they ripened. Many of those who had answered the call "go west, young man" were disillusioned. Those who remained produced from their Red Fife crops the world's best baking quality wheat—when it was not frosted. It was William Saunders, the first Director of the Dominion Experiment Farms, who suggested that the high baking quality but late-maturing Red Fife wheat should be crossed with the insignificant but early-maturing Hard Red Calcutta received from India. It was his son, later Sir Charles Saunders, who eventually selected from this cross a strain which at Indian Head in 1907, matured a plump grain while everywhere round it were shrivelled ears of frozen wheat. Within a few years this wheat, Marquis, still the standard of baking quality throughout the world, occupied 90 per cent. of the Canadian spring wheat belt and is estimated to have added £20,000,000 annually to the Dominion's income.

But Marquis, too, has now been displaced by its stem-rust resistant progeny Thatcher, which in 1940 was estimated to have been sown on 17½ million acres of the North American spring wheat belt. Since its release in 1935, Thatcher has been unaffected by the rust "demon" which has destroyed millions of acres of other varieties during the same period. Hayes of Minnesota was not satisfied with the researches which claimed that the rust resistance of the durum or macaroni wheats could not be transferred to the bread wheats. He crossed Marquis with the highly resistant durum wheat called Iumillo. From this cross he selected the "impossible"—a rust resistant bread wheat which, twenty years after the original cross was made, gave rise, through further crossing, to Thatcher. In Canada it is now claimed that stem rust susceptible varieties have "practically disappeared from the 'rust areas' since 1936"—a triumph for scientific plant breeding.

It is over fifty years ago that William Farrer led the way in this science of plant improvement. We are apt to think only of Farrer's contributions to the Australian wheat farmer, of his partial combination in Federation, for example, of the baking quality of the Fife wheats with the early maturity of the Indian wheats and the yield of the Purple Straws. Largely through the release of such early-maturing and high-yielding varieties as Federation and Bobs a threefold increase in wheat acreage occurred within a period of twenty years, thereby introducing Australia as a significant contributor to the world's wheat market. It was because of these achievements that the late Mr. George Walker was wont to refer to Farrer as "Australia's greatest benefactor". We can think of him too as Australia's greatest agricultural scientist—one who, during the brief twenty years of his wheat researches, demonstrated the success of the scientific approach to plant improvement by the creation of such relatively stem-rust resistant wheats as Warren and Florence, such strong-flour wheats as Cedar, Jonathan and Comeback, such a leaf-rust resistant wheat as Thew and such moderately bunt resistant wheats as Florence and Genoa. That was William Farrer, the retired Maths. Wrangler of Cambridge University, toiling at Lambrigg with the optimism of youth in an effort to prove a brilliant guess—that rust resistance, bunt resistance and high baking quality were heritable characters capable of being synthesised in a perfect wheat variety.

Science and Social Progress.

It is perhaps more than mere coincidence that these plant improvers were trained scientific thinkers. They were successful in the acceleration and direction of plant evolution because they used the scientific approach to their problems. The acceleration and direction of the social and economic evolution of our rural life and

the rational organisation of farm production is surely no less in need of the application of scientific thought.

Admittedly, as attention is directed to the field of the less exact social and economic sciences, difficulties of investigation are increased because of those human frailties which are themselves so largely the result of the chaotic and therefore unscientific environment in which we live. Difficulties there are, caused by emotional ties with methods no longer of intrinsic value, and by our inability to be entirely disinterested in considering changes which may appear to run contrary to our personal objectives.

For example, if science is but "common sense . . . freed from the influence of emotion", is it scientific to decline to investigate fully and impartially systems of finance, land tenure and agricultural production, which have proved successful elsewhere, only because they do not appear to be in keeping with British traditions or with the individualism so necessary in the great Australian pioneers and in the earlier developmental stages of agriculture.

In considering the organisational disorders of our rural life, it is only possible to draw attention to some existing weaknesses and to suggest alternatives, which might be tested out, if we are prepared to think and act scientifically in the field of the social and economic sciences. Are we prepared to accept the advice of our trained technical experts when dealing with the diseases of our crops and stock, but to treat as visionary and unpractical those who seek to diagnose impartially and treat scientifically our problems of rural organisation?

National and International Planning.

Nationally we still boast of our sovereign rights in a fast contracting world and individually of our independence and "rugged individualism". We are content to engage in cut-throat competition on the world's markets, at least while prices are good, and to appeal for contributions from the public coffers when they are not. Yet even in Australia, there has been considerable control of production in industries such as sugar, rice, flax, dried fruits and even wheat. The United States has gone as far as attempting to stabilise producers' incomes by all-risk crop-insurance schemes which insure even against drought. Is it not possible that the orderly production on a world scale, and according to plan, of the major primary products at controlled prices would give a far greater degree of security and real welfare to farmers and therefore to the towns and cities so largely dependent on them?

There can surely be no question of Australian producers wishing in the post-war period to revert to a policy of *laissez-faire*. The danger of an unscientific attitude developing lies chiefly in the probable unwillingness of sectional interests to cooperate fully when open competition on the world's markets may appear to be to their immediate advantage. The desire of such sections of producers to capitalise on a probable shortage of raw materials in the immediate post-war period may react drastically, however, against their future security. The active participation of Australia in plans such as those initiated at the recent United Nations Food Conference at Hot Springs, Virginia, U.S.A., is surely, even on the lowest plane, a matter of self preservation for a nation which exports in normal times approximately sixty per cent. of its primary produce.

International planning implies also the need for planning on a national basis. Already Soviet Russia, the United States and, to a lesser extent, Great Britain, have largely planned the production of their individual farms, so that the nation as a whole will produce what is required in the quantities required. Conservation of soil fertility as a national asset has been an additional objective in planning.

Under the stress of war, our Commonwealth agricultural administration has been strengthened. The Commonwealth Food Controller has recently been granted

wide powers to control the production, marketing and processing of agricultural products. Without the continuation of adequate Federal powers in the post-war reconstruction period, however, there may well be chaos in our national life. Yet, in the proposed Commonwealth Powers Bill, primary production is specifically excluded from the Federal sphere of control except by consent of the States. Can such an omission as agriculture from Commonwealth control, already assumed for purposes of war, be considered rational or scientific?

There is a justifiable fear in the minds of farmers that the planning and control of primary production might lead to regimentation. Such control may, however, be reduced merely to coordination at "the top" if producers themselves will cooperate fully in agricultural administration through District War Agricultural Committees and Local Committees. Such activities should also help materially to increase our social consciousness and develop a sense of community responsibility. It is significant that in U.S.A. since 1933 and in Great Britain and Australia under war-time conditions, increased control of primary production has been closely associated with, and dependent upon, the development of local committees of farmers. If in Australia at war or at peace such agricultural committees are to be successful as a democratic arm of government, backed by the weight of farmers' opinion, then care will be needed to see that such government "from the bottom up" is expanded while that "from the top down" is reduced.

That there is need for more scientific planning in Australian agriculture can scarcely be denied if attention is directed, for example, to the relatively low standard of technical efficiency on some farms, the wide and rapid fluctuations which have occurred in the prices of many farm products, the increasing indebtedness of the rural community, the high proportion of production claimed by capital as rent or under share-farming agreements, the existence of farms which are too small for efficient working alongside undeveloped and landlocked areas, the instability of rural awards and the absence of housing standards in country districts. Many of these troubles are beyond the control of the individual farmer. They are due primarily to the incompleteness of design in a system of farming, the evolution of which has been largely haphazard.

Is there not room for more scientific planning when farmers grow more but receive less? Between 1927 and 1939 rural indebtedness in Australia increased by approximately 20 to 25 per cent., and this in spite of a rise in total production of approximately the same order. Average prices received for farm products declined considerably further during this period than did the average cost of commodities purchased by producers. If as Mr. T. H. Bath, a Trustee of the Wheat Pool of Western Australia, states, it now requires in Australia 2½ bushels of wheat to buy the same amount of goods as was purchased by one bushel in 1911, then it is little wonder that, in spite of increased productivity per head, none but the most enterprising and efficient farmers have been able to bridge the gap between costs and prices. Indeed as late as November, 1942, Mr. Chifley, Federal Treasurer, placed the indebtedness of Australian farmers at over £400,000,000.

Planning Better Farms.

In view of the above trends, it is little wonder that many farmers have not paid labour a living wage, until the necessity for increased war-time production forced a solution, or that health standards are insisted upon when building homes in towns, while outside the municipalities any hovel is apparently good enough. Even many of the better farm homes are deprived, perhaps unnecessarily, of adequate sanitation, water supply, electrification and medical and educational facilities. It is suggested that a more scientific planning of the utilisation of Australia's national resources according to need could remedy most of these disabilities within a decade.

It is true that many Australian farms, which as a class are commercial farms operating for profit, are highly efficient. There are many farmers, however, who are not prepared to adopt well tested scientific methods of production. Could not many of these men do more useful work and enjoy a fuller life as members of a cooperatively organised food-producing team? It has been suggested that the resource in shortest supply in the dairy industry is managerial ability. Whether this is so or not, it can scarcely be claimed that due weight has been given to, or adequate experiments conducted with, alternative methods of cooperative or community farming designed to raise the efficiency of production by better management, greater specialisation of personnel, reduced capitalisation and the fuller use of technical improvements which, at the present time, are available only to a minority of farmers.

In this respect, it is of interest that the New South Wales Government has recently recognised its responsibility for increased efficiency in the dairying districts by providing mechanised units to be community-owned and community-operated. If efficient operation results in more economical production, this innovation might well prove the basis of revolutionary changes, by placing the benefits of technical progress more completely at the disposal of many of the smaller Australian farmers. That barely twenty per cent. of our dairy farmers use milking machines is further evidence of a lag between technical progress and practices.

Of wheat-farmers, too, only about half use tractors. Many of these are not the best procurable for the tillage, sowing and harvesting implements in use or for the size of the farm, which in some instances has not altered since the "horse and buggy" days of settlement. Many farms are too small to allow the effective use of the large and efficient power units now available.

There are farmers also who are unwilling or unable to use rotational practices which have been proved to be profitable and to maintain soil fertility. Surely the community should exercise some control over the conservation for posterity of national soil resources rather than that the landholder should continue to retain power of "life and death" over his property. It is surely legitimate for the State, preferably through farmers' committees, to assume some responsibility for the preservation of soil fertility, as it did in many European countries prior to the growth of the rank individualism of the eighteenth century.

The time appears opportune for Australia to plan production, using subsidies on soil improving crops and better farming practices as a means of achieving a long-range policy of soil conservation. Such a policy has achieved in the United States an extension of better husbandry, which propaganda alone never could have achieved. There is a danger in Australia of subsidies paid in the form of increased commodity prices alone, lowering rather than raising the efficiency of farm production.

The stabilisation of exchange values for at least the major primary products on the lines of the American "parity" concept may represent a palliative to many of the farmers' disabilities, especially if coupled with other devices for securing farm incomes. Amongst these are control of land values and interest rates, all-risk crop insurance and the food-stamp plans used for the distribution of some surpluses. Is it not probable, however, that the root causes of increasing indebtedness, rural poverty, inefficiency and soil exploitation lie deeper—perhaps in a decaying system from the mould of which fresh life will spring? At least there should be more willingness to analyse scientifically systems of land tenure and farm organisation, if this land, which is still ours, is to be more fully developed. It cannot much longer remain the most sparsely populated country in the world though situated alongside the most densely populated. To develop it, attention should be paid not only to world markets as an outlet for primary production but also to a higher living standard for the people and to population increase both natural and immigrant. With this should be coupled a policy of planned decentralisation dictated by national needs and not solely by commercial and financial interests.

In spite of an arid interior, almost limitless possibilities lie ahead if a planned agriculture is integrated with planned secondary industries. Does not the history of those, who like Farrer have carried the torch of scientific progress thus far, urge us to see to it that in future the only limit to development in Australia is set by what can be achieved by "seven million pairs of hands"?

These things will be when, in sufficient numbers, we awake to a realisation of the wealth of material and spiritual resources which awaits, not the transformation of the alchemist but the gradual and perhaps disturbing influence of scientific thinkers, who are prepared to observe closely, test carefully, plan loyally and act boldly in the interests of human progress.

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Rural Sociology in the United States

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Rural Sociology is a social science concerned with the application of sociological theory and practice in the field of rural social relationships. In the United States, this science is approximately as old as the century and has been steadily growing in stature. To workers in agricultural science in this country, the knowledge that rural sociology has acquired the prestige and dignity of a well-established science in the United States may come as a surprise. Its status is shown by the demand for its experts in administrative work and the inclusion of separate departments in rural sociology in many universities. The quarterly journal, *Rural Sociology*, has 900 subscribers. Congressional funds have been appropriated for the development of rural sociology at State Agricultural Experimental Stations since 1925.

Wartime rôles of American rural sociologists include the Special Services Section of the U.S. Army, the Office of War Information, the Office of Price Administration, and the Office of War Agricultural Relations. Several prominent rural social scientists were appointed as attachés for limited periods to U.S. Legations in Mexico, Argentina and Brazil within the last two years. American Red Cross has issued a call for sociologists to act as counsellors to men and women in the U.S. armed forces in matters relating to personal and family problems and to plan and organize recreational activities. In addition, wartime expansion of the activities of the U.S. Department of Agriculture has been responsible for the influx of rural sociologists to fill many new posts.

Present-day Programmes of American Rural Sociology.

Probably one of the most important activities of rural sociology in the United States is its rôle in analysing and planning agricultural programs and policies. Within the United States Department of Agriculture, rural sociology is most strongly represented in the bureau charged with planning agriculture, that is, the Bureau of Agricultural Economics, of which Farm Population and Rural Life is a Division headed and manned principally by rural sociologists. Another division well-supplied with rural sociologists is the Farm Security Administration which was established in 1937 to carry out a program of rural rehabilitation for low-income farmers by means of loans, resettlement and rehabilitation projects. In addition, the construction and maintenance of camps for migratory agricultural workers is the responsibility of this division.* Here, the experience gained by the Farm

* One of these camps was filmed at Tulare, California, for the screen version of John Steinbeck's *Grapes of Wrath*.

Security Administration with fixed and mobile camps has been utilized by the U.S. army. The U.S. Department of Agriculture also cooperates in teaching, research and extension work in rural sociology with the State Experiment Stations, colleges, universities and research institutes.

The program of activities undertaken by rural sociologists in the United States is principally concerned with surveys of social conditions of life in rural areas. Other projects include the following: population and migration studies (composition and trends); studies of the relationship of population and social organization to natural resources and technological development; the activities of rural youth; rural-urban relationships; consumer purchases studies; effects on rural social life of governmental programs, policies and legislation; effect of tenure status on social relationships; problems of rural poverty and slums; race and culture contacts; community and neighbourhood mapping; community organization; the development of long-term programs of land use; the history of development of rural institutions; settlement and resettlement studies; the development of rehabilitation programs for the human resources of defined areas.

“Community” and “Neighbourhood” in American Rural Sociology.

In the field of research, the general tendency has been for rural sociologists to identify the science with the study of rural groups, and in particular, those known as the “rural community” and the “rural neighbourhood”.

Once the boundaries of these natural social groupings have been determined, a number of important results may follow. Before beginning a description of the method commonly used for delineating rural communities and neighbourhoods, the characteristics of these natural social groupings may be set out. The *neighbourhood* contains “people . . . who feel and display in their behaviour a sense of belonging to the local area and group. The residents . . . know each other intimately.” Neighbourhood loyalty is strengthened by attendance at the same church, club, school, and the use of common places for trade and recreation. Informal social activities such as house visiting, exchange of work, and mutual borrowing and lending of equipment and supplies, distinguishes the neighbourhood from the community. The *community* is a larger natural grouping composed normally of a cluster of neighbourhoods. In most cases, the community includes the whole or component parts of neighbourhoods. Residents probably use common institutional facilities. The township trade centre may serve as a community centre where people from various neighbourhoods within the community meet either for social, economic, political or recreational purposes. A number of sociologists have suggested that the school area may, for practical purposes, be considered to be identical with the rural community. Some have gone even further in suggesting that the community centre proved to be located at the site of the consolidated high school. This would then make the high school the real centre for all community meetings. For practical purposes, then, “the basic assumption is that within the communities, the adults will probably *know* of each other to the extent of a speaking acquaintanceship”.⁽¹⁾ In a hypothetical case, a meeting called by a district agricultural officer in order to reach all farmers of a community may prove to be a failure as evidenced by poor attendance, lack of interest, or it may even be discovered later that whole areas were not represented. Subsequently, after community delineation has been carried out, it may have been found that the meeting did not take place at the “natural” community centre. All members of the community have therefore not experienced the desire to assemble at such a place, while some may even have resented the request that they do so. As far back as 1921, one rural sociologist possibly witnessed similar situations when he wrote that he was convinced that “there are real groupings in the open country and that these groups are of such importance as to render any scheme of organization questionable which deliberately leaves them out of considera-

tion”⁽⁴⁾ In recognizing the importance of these groupings, he was to anticipate the consensus of rural sociologists today. Briefly, then, the delineation of neighbourhoods and communities enables the representation of the people of these natural social groupings so that effective working and planning units may be created within each local government area.

Delineation begins with an examination of a large-scale map of the shire containing roads, highways and the sites of churches, schools, stores and post-offices. A meeting is held to which are invited representatives of agricultural agencies, public officials and community representatives and leaders. This group which is often referred to as the Agricultural Workers’ Council, includes the district agricultural officer and his assistant, officials of the Agricultural Adjustment Administration, the Home Demonstration Agent, representatives of the Farm Security Administration, and other agricultural agencies (Federal, State or local government), the Superintendent of Education, and the planning and A.A.A. committee men consisting of farmers elected within the local government area. After explaining the aims of community and neighbourhood delineation and these concepts, approximate boundaries of communities and neighbourhoods are obtained from the assemblage and plotted on the map. In addition, community centres are indicated. From this group of people, the names and addresses of all persons and groups who would be expected to be well-informed about their local neighbourhoods and communities are obtained. The designated persons and groups are next interviewed concerning their neighbourhood and community adherence and the information added to the map. The result of all this permits the plotting of boundary lines of both neighbourhoods and communities after the necessary checks have been made with those living near these boundary lines. In some cases communities consist of single neighbourhoods, but in the majority of cases they comprise a cluster of neighbourhoods. In this manner the community or neighbourhood boundary, determined as the composite of the opinions of a number of the resident people, is mapped in American rural areas.

It will be appreciated that rural people armed with information concerning the extent and leadership of their natural social groupings are in an advantageous situation with regard to organizing and planning their social life and agricultural activities. In time of crisis, as at present, organized rural communities and neighbourhoods are obviously more efficient in rendering service than unorganized ones. It is therefore not surprising to learn that the mapping of rural communities and neighbourhoods based on sociological principles, followed by the election of leaders for these groups, has usually resulted in an increased impetus being given to wartime campaigns in rural areas of the United States. Examples of such campaigns are those for scrap iron, farm machinery, rubber collection, victory gardens, war savings, and blood donations. Today, it has already been demonstrated that “wartime messages *can be* carried quickly to practically every family by the neighbourhood’s leadership system”.⁽³⁾ Tomorrow, these organized groups will serve as units in planning post-war production and living. In the meantime, land-use planning and soil conservation activities appear to be most effectively carried out today when cognizance is taken of existing communities and neighbourhoods. A prominent social scientist attached to the U.S. Department of Agriculture concludes that by means of the neighbourhood-community approach, people have become intimately associated with planning in such a way that “they gather their own facts, do their own planning and take action as a group”.⁽²⁾

Training American Rural Sociologists.

A list of the most prominent universities in the United States engaged in teaching and research in rural sociology would include the following: Harvard University, Cornell University, Louisiana State University, University of Wisconsin, University

of North Carolina, Columbia University, University of Minnesota, University of California, and Iowa State College.

It is of course impossible to set out details of the subjects taken at these institutions in the training of future rural sociologists. However, in general it may be said that the young sociologist begins his training by taking a four-year course leading to the degree of bachelor of arts and majoring in either sociology or rural sociology. In the first year as a freshman, the list of subjects would be that of a first-year for any science degree. They would include English, history or social science, mathematics and military science or physical education. In the second or sophomore year, the subjects would show a decided tendency towards the social sciences. The list would probably include introductory sociology, economics, anthropology, psychology, rural or urban sociology and military science. After completing his third (junior) year, the intending sociologist would probably have added the following subjects to his list: marriage and family relationships, population problems, agricultural economics, leadership, general sociology and social organization. The senior year would find his list of subjects increased by the following: rural social problems, criminology, rural social organization, survey of a rural community, social psychology, economics and labour problems.

On graduating, there are generally two avenues open. One is to seek an immediate appointment, generally as an assistant in a research project in rural sociology either at a university or with a State Department of Agriculture. The other is to continue on with the master's degree before seeking appointment. The latter course is more often followed, particularly as the M.A. becomes more and more prerequisite to appointment as a rural sociologist. Graduate work would consist in the completion of a certain quota of approved subjects as well as the writing of a thesis. During the year of graduate work, major subjects would be chosen from a long list including the following: social statistics, research methods in the social sciences, social theory, public opinion analysis, sociology of land tenure, standards of living. Minor subjects would probably be chosen from the fields of either economics, agricultural economics, psychology, anthropology, philosophy, government, education or history. Graduates are often employed part-time as research assistants in research projects in rural sociology. The candidate's thesis must be written on one of his major subjects and must take the form of an exhaustive study either on a field problem or a particular aspect of sociological theory. In a number of universities, masters' theses must be published. Finally the examining committee subjects the candidate to an oral examination on his thesis and general course work before admitting him to the higher degree.

After this training such a person is deemed qualified to undertake either research, teaching or extension work in rural sociology. He may be employed at a private or State institution in these capacities. If he seeks a Federal post, he is required to take a Civil Service examination in rural sociology, to obtain high results and to be placed in order of merit.

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TECHNICAL NOTES

THE ULTIMATE pH VALUE OF THE SOIL AND ITS RELATIONSHIP TO THE COMPOSITION OF THE CLAY FRACTION.

The pH of a soil which has been electro dialysed to remove exchangeable ions is usually referred to as the ultimate pH value and there are now a number of records of such values in the literature. The soils so treated may be regarded as being free from exchangeable metallic cations and the clay colloid to be fully saturated with hydrogen. Generally speaking there is a marked relationship between the ultimate pH value and the silica-sesquioxide ratio of the clay fraction, and it is the purpose of the present note to bring together the more important records from the United States and India and to compare these with a set of records for Australian soils recently obtained in these laboratories. The American records are those of Mattson⁽²⁾ and of Anderson and Byers.⁽¹⁾ Only such data were omitted as related to podsollic soils in which the separated colloids contained a high proportion of organic matter. The Indian records are those of Sen and Deb.⁽⁵⁾ To those may now be added the results for a group of 36 Australian soils for which analyses of the clay fractions were available. The Australian soils were selected from those described by Prescott and Hosking⁽⁴⁾ and Piper.⁽³⁾ They included two soils described by Wood.⁽⁶⁾

The cell used for the electro dialyses was designed for use in these laboratories by Mr. R. J. Best. It consists of an outer beaker of spun copper fitted with a tubular overflow and an inner chamber consisting of a porous cylindrical jar. The annular space between the two containers forms the cathode chamber, the inner vessel containing the soil is the anode chamber, the anode being of platinum gauze. The continuous endosmotic flow into the cathode chamber is balanced by the periodic restoring of the water level in the anode chamber. The E.M.F. applied is 80 volts.

Thirty grams of soil were electro dialysed in each unit and each soil was first leached with sodium chloride as in cation exchange estimations. The soil was then washed with 40 per cent. alcohol until free from chlorides. This saturation of the soil with sodium was designed to overcome the difficulty often experienced through the slow removal of exchangeable magnesium by electro dialysis.

The sodium-saturated soil thus obtained electro dialysed very quickly, and the dialysate was titrated until the known amounts of exchangeable cations were accounted for. Each dialysis occupied two to three working days and the dialysate usually amounted to three litres. The treated soils were recovered by transferring to a Buchner funnel and washing with distilled water. After air-drying and simple grinding the reaction (pH) was determined in a 1-to-5 suspension in water by means of a glass electrode system.

The relationship between the pH values of the soils and the silica-sesquioxide ratios of the clay fractions of the same soils is illustrated in Fig. 1. In the records of the Indian and American soils given alongside for comparison the separated colloids were electro dialysed and not the whole soils. A further difference is that in the American and Indian soils a three compartment cell was used so that exchangeable anions could also be removed. The three sets of data, however, fall into a reasonably common group with a marked correlation ($r = 0.856$) between the ultimate pH value and the silica-sesquioxide ratio.

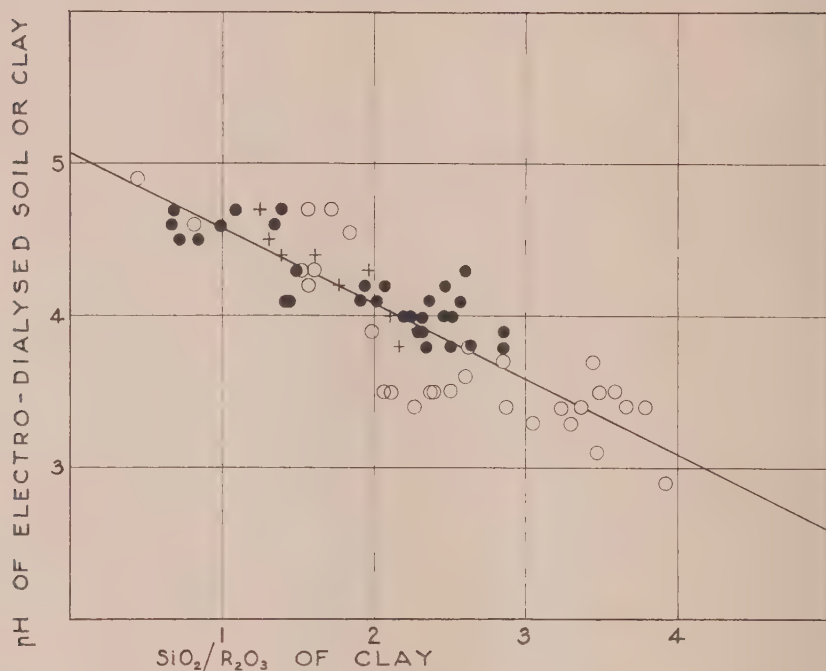


Figure 1.

Illustrating the relationship between the pH values of electro-dialysed soils and clays and the chemical composition of the clay fraction. The open circles relate to American records, the crosses to Indian records and the black circles to a group of Australian soils now recorded for the first time.

The line of regression of pH on silica-sesquioxide ratio is also drawn.

The regression equation connecting the two values is

$$\text{ultimate pH} = 5.06 - 0.488 \frac{\text{SiO}_2}{\text{R}_2\text{O}_3}$$

That is, a clay fraction consisting almost entirely of aluminium and iron hydroxides could be expected to have an ultimate pH value in the neighbourhood of 5.

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ROOT TYPES AMONG APPLE CLONES RAISED FROM ROOT CUTTINGS.

Among the crossbred apple seedlings which have been raised in an apple breeding programme and grown for several years in plantations at Bathurst and New England Experiment Farms, New South Wales, a number have shown characters, such as good vigour and freedom from Woolly Aphis, which suggest that they are worthy of propagation for trial as clonal rootstocks. The first selections were made in 1935 and fresh selections were made in subsequent years until by now a total of some 50 clones have been raised at Narara Nursery, New South Wales. The clones were propagated by root cuttings, as in the warm coastal climate prevailing at Narara the method of using root cuttings has the advantage of often producing a nursery tree in one year less than the method of using stools and root pieces it does away with the need for maintaining stool or layer beds and is an economical way of multiplying the initial clonal rootstock material. Observations were made on the various characteristics such as percentage strike, vigour, etc., which would govern the use of root pieces for commercial nursery work. In the present paper the observations on root type are discussed.

In the more usual methods of vegetative propagation of the apple by stools and layers, roots are produced from shoots; and root systems produced as a result of layering have been described for the East Malling stocks⁽²⁾ and for a number of commercial varieties.^(3,4) In root cuttings, the roots (and shoots) are produced from roots, and when the present work was begun the types of root systems that might eventuate and the degree of success which might attend the extensive use of root pieces as a means of vegetative propagation were unknown. In 1941, however, a survey of all the root types occurring in crossbred apple seedlings grown at Narara was published.⁽¹⁾ It appears that the apple clones derived from root cuttings show a rather similar range of root types.

Method of Establishing Clones.

The selected seedlings were first propagated vegetatively by grafting together pieces of the stem and root from each seedling. The resulting plants were allowed to grow for three years to form mother plants, which on lifting provided appreciable numbers of root cuttings.

Root pieces, 5 to 6 inches long and varying in diameter between the thickness of a lead pencil and a slate pencil, were set 3 or 4 inches apart in nursery rows 3 feet apart, with the top of the piece slightly protruding above soil level. The clones varied considerably in the percentage to shoot, the vigour of growth and the percentage forming buddable trees by late summer. After two years' growth, when, according to the clone, the stem varied from four and a half to over six feet in height, the clones were dug and root cuttings taken for re-propagation. At this time, the clones were equivalent in age to one-year old budded trees and had developed extensive root systems, such as shown in Figures 1, 2 and 3. To secure as much root material as possible, as well as to recover the main root systems as completely as possible, the method adopted for lifting the plant was that of opening up on each side of the nursery row a trench from which a spade was sunk obliquely.

Root Systems.

Each clone shows great uniformity in root type, although there is naturally some variation between the plants of a clone in size of the root system. The range of root types appearing among the clones is shown by representative plants from certain clones in Figures 1, 2 and 3. Variation is *continuous* from Figure 1 to Figure 3*d*. The range is divisible broadly into three types, of which two have fibre

clusters arising directly from the root cutting, and the third lacks these characteristic fibre clusters. The three types are as follows :

(1) Clones which produce a mass of fibrous roots, spreading laterally in the soil, without good anchorage roots (Figure 1).

(2) Clones having fibrous roots which also have some anchorage roots (Figure 2*a, b, c*). It is usually found in this type that as the number of anchorage roots increases, the amount of fibrous root arising from the cutting decreases. The fibrous roots tend to arise from the upper portion and the stronger anchorage roots from the lower portion of the cutting. Where there are no anchorage roots, as in root systems of type 1, the fibre is more profuse at the upper end of the cutting, indicating its similarity in point of origin to the crown fibre of seedlings. The fibre may vary in profuseness, length, and to some extent in fleshiness, but typically it arises in clusters as does the crown fibre of those apple seedlings which have the crown rooting character. The habit of growth of the anchorage roots appears to vary independently of the fibre. The anchorage roots may be of rather lateral spread or strongly descending and the terminal root may grow straight down from the end of the cutting, or grow at a shallow angle forming a heel.

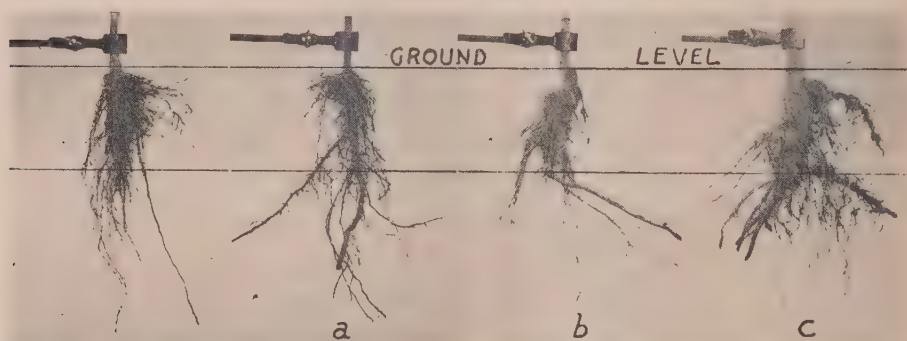


Figure 1.
Crown-rooted clone.

Figure 2.
Clones of intermediate root type, having both crown-root and tap-root systems.

Length of original root piece is shown as the distance between the ground level and the lower line.

(3) Clones without fibre clusters arising from the root piece (Figure 3). The development of the root system may take place along the length of the root piece (Figure 3*a*) or it may be confined to the lower portion (Figure 3*c*). However, the upper portion of the root piece which in types 1 and 2 produces the most profuse fibre, is practically bare of roots in most clones of this type. The extreme of this group are clones which produce a single strong root from the lower end of the root piece (Figure 3*d*). So far, a clone in which the strong roots are confined to the upper end of the root piece has not occurred. Clones of type 3 are very firmly rooted in the soil, although the form shown in Figure 3*d* is readily lifted once the main root is severed. To obtain clones shown in Figure 3 without excessive loss of root, it was necessary to lift them after deep trenching along the side of the nursery row.

Relation to Root Types of Seedlings.

In discussing the root types occurring in a large number of apple seedlings of varied, known parentage,⁽¹⁾ the author indicated that rooting characteristics showed a *continuous* variation from an extremely crown-fibrous class to a crown-fibreless,

tap-rooted class. The seedlings were readily classified into three types, namely type 1, crown rooted; type 2, intermediate; type 3, tap rooted. These types appeared to be due to the presence or absence of crown rooting and, if present, how it affected the development of the tap root. It was stated, "Tap-rooted seedlings are so rooted because they do not inherit, in their make-up, the crown-rooting character, or inherit it only in the recessive condition. Once the crown-rooting character enters largely into the make-up of a seedling it does one of two things:

"(1) It accompanies the tap-rooting system, perhaps reducing it slightly, and gives the intermediate root type; the amount of crown fibre varies from a little to as much as can be found in type 1; or

"(2) It inhibits and supersedes the tap-rooting system; the crown roots form a whorl of roots, originating in the first couple of inches below ground level, a part of the tap-root which is almost bare of roots in the tap-rooted type. The superseding crown roots may vary from strong, stout roots to a mass of fibre."

It is apparent that the root types of apple seedlings have been vegetatively reproduced by root cuttings, Figure 1 representing the crown fibrous root type,

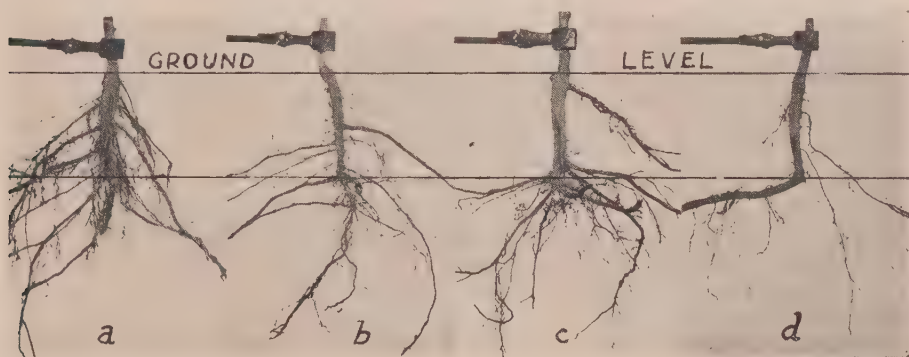


Figure 3.
Clones of tap-rooted, crown-fibreless type.

Figures 2a, b, c representing the intermediate root type having both crown fibre and the tap-rooting system, and Figures 3a, b, c, d representing the tap-rooted type of seedling. Further, a similar influence of crown rooting on the later development of the root system occurred when a root piece was used as when the root system started from a seed.

The author wishes to gratefully acknowledge the assistance of the Superintendent of Narara Nursery in the field work of this investigation.

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THE COMBINATION OF STEM RUST RESISTANT GENES FROM THE WHEATS EUREKA AND WARIGO.

Eureka⁽¹⁾ and Warigo⁽⁶⁾ are two new Australian stem rust resistant varieties of wheat deriving their resistance from Kenya C.6040 and Hope respectively. As both varieties are being used as parents in further breeding work it is important that we should know something of the genes governing their resistance to *Puccinia graminis tritici*.

Briggs and others at California have identified and named several of the many genes governing the resistance of wheat to *Tilletia tritici* and of barley to *Erysiphe graminis hordei*. No similar systematic study has been made in an attempt to show the relationships of the many "stem rust resistant" genes which are known to exist in our wheat varieties. However, we know a great deal about the mode of inheritance of several of these "stem rust resistant" genes and also of the environmental conditions necessary for their expression.

With the advent of a new physiologic race of *Puccinia graminis tritici*, or with the onset of unusually favourable conditions for the development of the fungus, "resistant" genes may become ineffective, so that a previously resistant variety becomes, either permanently or temporarily, a susceptible one. Many examples illustrating both types of breakdown could be quoted, but at this stage it is sufficient to mention two recent cases.

Garcia-Rada *et al.*⁽³⁾ have reported the occurrence of a virulent race (No. 189) which is capable of attacking all the twelve differential wheat varieties and also Hope and *Triticum timopheevi*. They suggest that the new race may have arisen from an unusual combination of genes following sexual fusion on the barberry.

An interesting but rather disturbing breakdown of resistance has recently occurred in New South Wales, where Macindoe⁽⁴⁾ reports a breakdown in the resistance of Eureka during an epidemic in northern New South Wales in 1942.

In the light of this experience it may be that no single gene or genes derived from one variety will provide complete resistance to stem rust. However, the combination of genes from two or more varieties each carrying different genes for resistance will probably confer a greater degree of resistance and freedom from breakdown than will any one gene. This paper records the successful combination of a "physiologic resistance" gene from Eureka and a "mature plant resistance" gene from Warigo by the use of a short-cut method.

The Resistance of Eureka.

Macindoe⁽⁵⁾ has investigated the inheritance of resistance in several Kenya derivatives including Eureka. Most of his tests were conducted at high temperatures when Eureka is susceptible. At low temperatures (60° F.) Eureka is resistant, as are the two crossbreds (Kenya × Gular) and (Bobin × Gaza × Bobin). Under these conditions Macindoe demonstrated a two-factor difference in crosses involving two resistant parents: Eureka × (Kenya × Gular) and Eureka × (Bobin × Gaza × Bobin). These tests were made using seedling plants and race 34 of *Puccinia graminis tritici*.

Under field conditions at the Waite Institute, Eureka has always been resistant, but we have no evidence of the mode of inheritance of this field resistance to stem rust.

In tests with seedlings at low temperatures and using race 34,* we have found a single gene difference in crosses between Eureka (resistant) × Dundee (susceptible) and Eureka (resistant) × White Federation 38 (susceptible).

* The authors are indebted to Dr. W. L. Waterhouse of the University of Sydney for the race determination.

The Resistance of Warigo.

Phipps *et al.*⁽⁶⁾ have shown Warigo to be susceptible in the seedling stage to race 34 so that the field resistance of this variety is of the mature plant type. Field trials at the Waite Institute, where race 34 predominates, have failed to indicate the number of genes which determine the resistance of Warigo. It would seem that modifying factors are present, for in crosses between Warigo and susceptible varieties the F_1 is intermediate in its reaction to rust and the F_2 and F_3 families segregate in a complex manner without a clear-cut segregation.

The mature plant resistance of Hope, the variety from which Warigo derives its resistance, has been shown by Clark and Ausemus⁽²⁾ and others to be dependent on two genes.

The Inheritance of Stem Rust Resistance in the Cross Eureka $\times$ Warigo.

Seedling Tests.

At low temperatures (60° F.), seedlings of Eureka are resistant to race 34, while those of Warigo are susceptible. In 1942 and 1943 evidence (Table 1) was secured from an F_2 of this cross which indicated that the low temperature resistance of Eureka seedlings to race 34 is dependent on the presence of a single dominant gene. Tests with F_3 families have confirmed this hypothesis.

TABLE 1.

*Observed and Calculated Results of Segregation in F_2 Families of the Cross (Eureka $\times$ Warigo) for Seedling Reaction to Race 34 of *Puccinia graminis tritici*.*

				Resistant.	Susceptible.	Total.	P for agreement with 3:1 ratio.
1942.	Observed			149	38	187	0.1-0.2
	Calculated.. ..			140.25	46.75	187.00	—
1943.	Observed			37	10	47	0.5-0.7
	Calculated.. ..			35.25	11.75	47.00	—

Field Tests.

In 1941 F_2 and F_3 rows of (Eureka $\times$ Warigo) were exposed to a severe natural epidemic of race 34. Both parents were highly resistant but susceptible segregates appeared in both the F_2 and F_3 families. The results of the F_3 segregation are set out in Table 2.

TABLE 2.

*Observed and Calculated Results of Segregation in F_3 Families of the Cross (Eureka $\times$ Warigo) for Field Reaction to Race 34 of *Puccinia graminis tritici*.*

				Homozygous resistant.	Segregating.	Homozygous susceptible.	Total.	P for agreement with 7:8:1 ratio.
Observed	..	76	89			17	182	0.2-0.3
Calculated	..	79.66	91.04			11.38	182.08	—

In contrast with the seedling tests on this material the field results of Table 2 indicate that in the cross (Eureka $\times$ Warigo) two independently inherited dominant genes for resistance are operating.

The progenies of susceptible field segregates have been further tested and they have proved to be susceptible both in the field and as seedlings in the glasshouse. Of the progeny from the field resistant segregates, some are homozygous resistant and some segregate when tested as seedlings. This behaviour is significant in that it provides a short-cut method for isolating the desired double dominant combination of genes.

Combined Resistance of Eureka and Warigo.

A method of combining the physiologic resistance of one variety with the mature plant resistance of another has been suggested by Macindoe.⁽⁵⁾ He states: "The physiologic resistance of (Kenya $\times$ Gular), for example, could be readily coupled with the mature plant resistance of Hofed I in a breeding program by selecting from the cross F_3 families which were heterozygous in the seedling stage to race 34, but at maturity homozygous for the mature plant resistance of Hofed I. By selecting therefrom plants resistant in the seedling stage to race 34, which in the following generation were found to be homozygous resistant to race 34, it would be possible to couple homozygous physiologic resistance and mature plant resistance in the same families."

Adopting this method it has been possible to combine the physiologic resistance of Eureka with the mature plant resistance of Warigo. Remnant seed of the more promising F_3 rows of (Eureka $\times$ Warigo), which were also homozygous resistant in the field in 1941, was available for testing as seedlings in the glasshouse in 1942. Those F_3 families which segregated with resistant and susceptible seedlings were selected. These families, while being heterozygous in the seedling stage to race 34, are known to be homozygous resistant at maturity, so that the homozygosity is that of the "mature plant resistance" genes. To secure homozygosity of the "physiologic resistance" genes as well, resistant seedlings were selected and the F_4 progenies of these were tested in the seedling stage in 1943. In this way a family (6543) homozygous for the "physiologic resistance" genes was secured, which thus possesses the double resistance—namely the mature plant resistance of Warigo and the physiologic resistance of Eureka. It is anticipated that this double resistance will be superior and more stable than the resistance of either Eureka or Warigo alone.

Triple Resistance to Stem Rust.

(Bobin $\times$ Gaza $\times$ Bobin) is a wheat possessing a single gene for resistance to race 34.⁽⁵⁾ The variety differs from Eureka and Warigo in that it possesses a seedling resistance at high temperatures—the single gene behaving as a simple dominant.

We are now employing the back-cross method in an attempt to supplement the double resistance of strain 6543, where strain 6543 is the recurring and (Bobin $\times$ Gaza $\times$ Bobin) the non-recurring parent.

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The Australian Institute of Agricultural Science

COUNCIL MEETING.

A Council meeting was held in the School of Agriculture, University of Melbourne, on 5th July, 1943.

Present.—Mr. J. A. Aird (V.) (in chair), Dr. A. E. V. Richardson (S.A.), Mr. G. H. Vasey (N.S.W.), Mr. F. S. Crawford (T.), the Honorary Treasurer, Mr. R. L. Twentymen, the Honorary Secretary, Mr. A. J. Vasey, and the Assistant Honorary Secretary, Mr. R. D. Croll. Apologies were received from Dr. H. C. Forster (W.A.), Mr. R. W. Prunster (A.C.T.), and Mr. J. L. Provan (Q.). Mr. Crawford acted on instructions forwarded by the proxies for the A.C.T. and Queensland Branches. A cordial welcome was extended to Mr. Aird on the occasion of his taking the chair at a Council meeting for the first time, following his election as President of the Victorian Branch for 1943.

The Queensland proposal that by-laws should be prepared, covering the various decisions of Council on matters of administration of the Institute was approved, and the Honorary Secretary was instructed to proceed with the preparation of these by-laws, and authorised, if necessary, to obtain the assistance of the Institute's solicitors for this work.

On a majority vote, the proposal of the Queensland Branch that a portion of the funds reported as available by the Honorary Treasurer should be used to pay the expenses of delegates to a full Council meeting was not accepted. The Honorary Secretary was directed to attach to the minutes the very able statement of the Queensland delegate in support of this proposal. The proposal which originated at the Council meeting of 22nd February, 1943, that a grant of £25 should be made to each Branch, was not accepted on a majority vote. In view of the foregoing decisions on financial matters, the Honorary Treasurer was instructed by a resolution moved by Dr. A. E. V. Richardson (S.A.) and seconded by Mr. F. S. Crawford (T.), that a sum of £200 be invested in War Loan Bonds.

It was the opinion of the meeting that, in any future distribution of surplus Institute funds to Branches, half the amount available should be distributed at a flat rate to each Branch, and the other half distributed between the Branches on a *per capita* basis.

The following documents in connection with the Institute Journal were received and accepted: Report of the Business Manager on Volume 8, 1942; Report and Statement of Receipts and Expenditure from Auditors of the Journal account for the same period; Report of Editor on Volume 8, 1942. A motion congratulating the Editor and Business Manager on their excellent reports was moved by Dr. Richardson (S.A.), seconded by Mr. G. H. Vasey (N.S.W.). A further motion directing the Honorary Secretary to convey to the Editor, Business Manager, and members of the Editorial Committee the thanks of the Institute for their work on its behalf was also carried. Approval for an expenditure up to £220 on the Journal for 1943 was granted.

In a reply to the Institute's proposal regarding agricultural attaches in foreign countries, the Department of External Affairs indicated that, at present, the curtailment of facilities for travel, and other war-time factors, would render such appointments of little value. The proposal would, however, be reconsidered at a later date and the desirability of such appointments and the qualifications needed for agricultural attaches would receive consideration.

The following applicants were admitted to membership: Miss Alison Vines (S.A. Branch) and Messrs. G. C. Stubbs, L. Stubbs and H. G. Turner (Victorian Branch).

Messrs. Cleveland, Son and Hislop, of 20 Queen St., Melbourne, were re-appointed as Auditors of the Institute's accounts. The audited statement of accounts for the year ended 31st December, 1942, appears on page 134. Balance at bank on 5th July, 1943, was £364 8s. 4d.

Centenary of Rothamstead Experiment Station.

The following cable was despatched on 19th July:

"Centenary greetings to world-renowned Rothamstead from Australian Agricultural Scientists. May its future be brilliant as its past.

(Sgd.) Currie,

President, Australian Institute of Agricultural Science."

Further reference to Rothamstead's Centenary is given under *Current Notes and News*.

Report of Editor for Volume 8, 1942.

The four quarterly numbers of Volume 8 of the Journal contained 177 pages of text and 50 pages of advertisements, together with two pages of contents-tables and the usual 4-page index, which is issued as a supplement to the December issue.

Owing to the closer setting of the lines and the increased length of the lines of type, which were adopted as means to obtain more words per page during the currency of volume 6, it is estimated that the actual textual content of volume 8 closely approximates that of earlier volumes. It may well be a matter of considerable satisfaction to the Institute that the number and standard of contributions were maintained during the year, in view of the period having

been one of the greatest national stress to which this country has been exposed. Further than this, many contributions were notable for their distinctly topical tone and served to inform members upon current events as well as forming a record of developments affecting agriculture in these times.

The Journal is regarded rather as a professional than purely research journal. Many contributions are therefore found to deal with broad issues or are characterized by a broad treatment of more particular subjects, thereby having a more general appeal to members than articles of a purely scientific nature which often deal with a very limited field of work. Technical notes, which afford opportunity for more scientific brief articles, have included several valuable contributions and first records. In the section devoted to the Institute as informative an account of the proceedings is given as is consistent with brevity. Current Notes and News, Personal Notes and the other sections towards the end of each number form a current record of developments, comments and members' occupational changes.

Of the various sections of the Journal, articles occupied 110 pages, Technical Notes 36 pages, Proceedings of the Institute 14½ pages, Current Notes and News 7½ pages, Correspondence 3 pages, Personal Notes and Obituary Notices 3½ pages, and Book Reviews 1 page. The last five sections are set in 8-point type, which gives an increase in wordage per page of some 40 per cent. over the 10-point type in which articles and Technical Notes are set.

As the Journal of the Institute and the medium for the expression of views of the members and the Institute, it is of interest to observe from an analysis of the contributions that volume 8 contains 53 pages, or almost one-third of the entire contents, originating from the Institute in its corporate sense. These include 31 pages of articles (sponsored by Council or reports of branches or presidential addresses) and some 22 pages of 8-point matter (that is proceedings of A.I.A.S. and most of the Current Notes and News). The remaining 124 pages consist of the contributions of members in the individual or non-corporate sense.

At the beginning of 1942, the arrangements made for the division of editorial work were as follows: 'Dr. F. T. Bowman, editorial management of Journal and editing 8-pt. sections (A.I.A.S., Current Notes and News, Book Reviews, Correspondence and Personal Notes); Dr. E. T. Edwards, editing the more scientific articles; Mr. F. C. McCleery, editing the more general articles; Dr. I. A. Watson, editing the Technical Notes. This division of work is subject to adjustment, to allow the volume of work to be shared equally among the members of the Committee, and is also subject to rotation at a later date, if desired.

It is desired to acknowledge the active cooperation throughout the year of the Sub-Editors in the various Branches of the Institute, and to record appreciation of the superior work of the Australasian Medical Publishing Company.

MEETINGS OF BRANCHES.

New South Wales Branch.

A meeting of the N.S.W. Branch was held at Science House, Sydney, on the 9th July, with 23 members and six visitors present. The meeting was interested in the receipt of information from Dr. Edgar Booth, Warden of the New England University College, in respect of the suggested establishment of a Faculty of Rural Economy at Armidale.

The main business of the meeting was a talk on "Food Technology in Peace and War" by Major Carl R. Fellers of U.S.A. One of the points made was that the "proverbial young chemist" cannot be expected to be an adequate solution of most of the problems which occurred in the processing of food. Troubles in a processing plant may be chemical, bacteriological, engineering, agricultural or of personnel origin, and the food technologist must be sufficiently broad in his outlook and experience to see all possible aspects of the problem. A number of technical questions relating to canning, dehydration and cold-pack were discussed. Rapid development of cold pack in post-war Australia was predicted.

A well attended meeting of the N.S.W. Branch was held on the 27th August. Many members of the N.S.W. Division of the Australian Veterinary Association were present.

The main business was a symposium on "The Rationalization of Agricultural Education and Research in N.S.W." The principal speakers were Dr. Edgar Booth of the New England University College, Armidale, N.S.W.; Dr. E. G. Hallsworth of the Faculty of Agriculture, University of Sydney; and Mr. J. Noel Barret, farmer and grazier of Edgeroi, N.S.W., and Agricultural Adviser in the Commonwealth Department of Commerce and Agriculture.

Dr. Booth pressed a case for decentralization of agriculture and research, with particular reference to the desirability of a Faculty of Rural Economy which might well be established at the Armidale University College. Dr. Hallsworth reviewed the various agricultural research, education and extension organizations in N.S.W. and ventured the opinion that "the State possesses not one with the facilities and prestige worthy of its population and agricultural production". Mr. Noel Barret narrated many of his experiences as a farmer and grazier, illustrating an evaluation of university training in agricultural science. It appeared, rightfully, that no matter how comprehensive an educational curriculum may be, the individual may only safely regard his resultant qualifications as a key to opportunities to apply thought and reason to post-graduate experiences.

Victorian Branch.

Branch members attended the following meetings of the Melbourne University Agricultural Society :

On 28th May, the speaker was Dr. F. H. Shaw, Lecturer in Pharmacology at the Melbourne University, his subject, " Drug-Containing Plants—Native and Cultivated—Their Importance ". Pharmacology, said Dr. Shaw, was important to the agriculturist because (1) plants produced substances which were toxic to animals and (2) plants could be cultivated to obtain drugs for medicinal use. Toxicity of the plant in relation to animals varied according to species, age and sex, tolerance, season, etc. Indirect poisoning of human beings might also occur. Toxicological studies led to the discovery of substances useful in medicine.

The action of glucosides in liberating hydrocyanic acid by enzyme action, alkaloids (like nicotine) and plants containing unknown principles (cape tulip, dogwood, darling pea, St. John's wort) were also discussed. Myoporum or dogwood had puzzled many chemists, sheep and horses fed on darling pea quickly developed characteristic symptoms and died within a few months, while photosensitization followed ingestion of St. John's wort and exposure to light of unpigmented animals.

Dr. Shaw then spoke of the success which had attended Australian efforts, under the stimulation of war conditions, to develop drugs normally imported. Hyoscine (used for the treatment of bomb victims) and atropine were quoted as examples. A local anæsthetic had also been discovered. The speaker then referred to progress with introduced and cultivated plants and mentioned the encouraging results being obtained in the production of ergot, morphine, quinine, digitalis and strychnine.

Miss M. E. H. Cowen was the speaker on 25th June. Seed testing, the title of her subject, developed as a protection for the farmer but primarily as a convenient method of grading seed for the seedsmen, stated Miss Cowen. This fact had considerable influence in the development of technique and interpretation of results. Differences in technique, due largely to the difficulty of arriving at a uniform definition of what constituted pure seed, gave rise in Europe to the continental method of seed testing and in Great Britain proper to the Irish method. All European stations later adopted the continental system, calling it the " stronger method ", for the sake of uniformity. The " quicker " method was then developed in America and so far, uniformity has not been reached by the International Seed Testing Association. The " quicker " method is followed in the Melbourne laboratory.

In testing seeds there were three main points to be considered, continued Miss Cowen : (1) genuineness of the seed (trueness to species or variety), (2) purity (freedom from noxious weeds and the proportion of other crop seeds, other weed seeds and inert matter), and (3) germination (including germination vigour and germination capacity). Other special determinations which could be made were provenance determination, sanitary conditions of the seed, moisture content, weight of 1000 seeds and a dodder or similar examination for any particular weed seed.

The technique used was described with particular reference to methods used for varietal determination, such as the fluorescence test for perenniality in rye grass and the picric acid test for " wildness " in white clover. There were many problems in seed testing, stated the lecturer. These included sampling (being sure that the sample submitted was truly representative of the bulk seed), sampling down in the laboratory to get the working sample for the purity test, methods used in identifying weed seeds, germination tests and the judgment of abnormal seedlings, with particular reference to the appearance of " black tips " to the radicles in flax germination tests, control of saprophytic moulds, especially with peas and beans and prechilling to overcome delayed germination in freshly harvested seed such as Wimmera rye and flax.

Mr. M. Rothberg's talk, " Rural Sociology in U.S.A. ", given on 16th July, is published elsewhere in this issue of the Journal.

Western Australian Branch.

At a well attended meeting on 2nd July, Professor G. A. Currie delivered a post-presidential address on " Agricultural Education ". All phases were discussed with particular reference to Western Australia. The discussion which followed the address centred on the work and conditions of advisory officers. The views expressed by the meeting will form a basis for submissions by the Branch to the Rural Reconstruction Commission on the subject of agricultural education.

Current Notes and News

Centenary of the Rothamsted Experimental Station.

The centenary of the Rothamsted Experimental Station was officially celebrated on 21st July. There was a large attendance at Rothamsted and representatives of no less than twenty-eight nations took part. Sir John Russell, writing a few days later, says the day passed off extremely well, and that all felt it was a most happy ending to the first 100 years of work and a hopeful augury to the second. Many congratulatory messages were received from distinguished organizations in different parts of the world.

In 1843 began the scientific partnership of Lawes and Gilbert which marks the official beginning of the work at Rothamsted. In June of that year the first experiments were laid down on turnips, and in the autumn the first wheat under experimental conditions was sown on Broadbalk.

During 1837, 1838 and 1839 the young Mr. Lawes had carried out a number of experiments in pots and observed promising responses to the use of phosphates on turnips. He carried out further experiments on his estate in 1840 and 1841. He observed in these experiments the value of acid-treated bone ash and rock phosphate and in May, 1842, was granted by the London Patent Offices one of the two patents approved by that office for the manufacture of superphosphate.

These activities led to the appointment by Lawes of the young Dr. Gilbert as chemist and partner in the experimental work which was to become recognized as the Rothamsted Experiments and so founded the world famous station, the oldest in the world, to be followed in 1852 by the first German station at Möckern, near Leipzig, and in 1875 by the first American station at Middletown, Connecticut.

Lawes and Gilbert were not the first to apply the experimental method to the study of the field problems of agriculture; in this they were preceded by Boussingault in Alsace. The Royal Agricultural Society founded in 1840 also advocated field trials along these lines, but the Rothamsted work became continuous and increased in value yearly owing to this continuity.

When the Rothamsted work began both scientists and farmers were vague regarding the principles of plant nutrition. Liebig was the first in 1840 to drive home to his colleagues the basal fact of plant physiology that plants derive their carbon from the carbon dioxide of the air. Farmers currently believed that bones owed their merits as fertilizers to their oil content. It was accepted as possible that turnips, owing to their large leaf area, were capable of obtaining nitrogen from the air. These ideas Lawes and Gilbert quickly dispelled with their first experiments on turnips. The solution of the problem of the source of nitrogen for legumes eluded the Rothamsted investigators. Experiments on the subject were begun in 1857 in association with Pugh, but in order to remove all soil nitrogen the soils used were ignited, washed and re-ignited and so efficiently sterilized.

It was at the agricultural chemistry section of a Science Congress in Berlin in 1886, held under Gilbert's chairmanship, that Hellriegel and Wilfarth announced their explanation of the nitrogen nutrition of leguminous plants by symbiosis with the bacteria of the root nodules. This led to a new series of Rothamsted experiments starting in 1888 and continuing until 1890 confirming this explanation and completing the first phase in our knowledge of the major fertilizer requirements of crops and placing the fertilizer industry on a sound scientific foundation. A new phase dealing with the minor elements was opened at the Pasteur Institute in Paris in 1910 and this phase is at present in full development.

Rothamsted led the world a hundred years ago in the technique of field experiments. The vast amount of data collected over the years provided abundant material for statistical study, and from this grew the new developments in experimental method due to R. A. Fisher, which are designed to reduce error and, what is more important, to enable accurate estimates of reliability and significance to be obtained.

Most of the present generation of workers in agricultural science will think of Rothamsted under the direction of Sir Daniel Hall and Sir John Russell, a period during which new sciences were brought to bear on agriculture and laboratories built to serve these new developments. Sir John Russell retires at the end of September after thirty-one years as director. Dr. W. G. Ogg, of the Macaulay Institute for Soil Research, near Aberdeen, has been appointed to succeed. Rothamsted begins a new century with every promise of increasing usefulness.

J. A. PRESCOTT.

Report on Citrus Decline on the Murrumbidgee Irrigation Areas.

This 13-page report is produced by the Irrigation Research Extension Committee, which is composed of representatives of the N.S.W. Department of Agriculture, settlers' co-operative organizations (Joint Executive Committee), N.S.W. Water Conservation and Irrigation Commission, Rural Bank of N.S.W., and the C.S.I.R. Irrigation Research Station, Griffith.

Citrus decline is the name given to a deterioration in the health of citrus trees which has become particularly marked in the past five years. A survey carried out in 1940 indicated that only 53 per cent. of the 6,000 acres of citrus trees in the Areas could be placed in the category of being healthy. The outstanding cause is reported to be excess soil moisture associated with root decay caused by *Phytophthora citrophthora* (see this Journal, 8: 101-105, 1942); other important causes include soil deterioration and insufficient nitrogen.

The report is mainly devoted to a discussion of the methods by which it is considered the decline may be arrested.

Among natural factors aggravating the trouble, recurring wet winters, unsuitable soil types for citrus and defective natural surface drainage are discussed. As regards the first, the preparation of adequate surface drains and the desirability of light late waterings are stressed. The soil types of the Areas are grouped on the basis of their suitability to citrus, the unsuitable types comprising half the total area included in the survey. Soils are also classified on suitability of their natural slope, which is not necessarily the slope used for irrigation, unsuitable slopes being set down as less than 0.2 per cent. ($1\frac{1}{2}$ inches per chain). Recommendations are then made for both new and existing plantings, having regard to the combinations of soil type and natural slope.

Besides the natural factors, there are controllable factors in the form of farm practices, which by improvement can contribute to the arrest of citrus decline. The main practices contributing to the trouble are listed as being faulty irrigation layout, faulty application of water, inadequate removal of surplus water, seepage in isolated cases and difficulties in soil management. The variations of irrigation practice which are recommended are largely centred around the principle of providing the minimum irrigation, with the soil augur as the well known, but insufficiently used, means of gauging soil wetting. Watering alternate areas is stated to be helpful in the control of phytophthora and to improve soil aeration and structure. The use of spray irrigation is indicated for soil types with a sandy surface, some of which are unsuitable for surface-flow methods with citrus, and tile drains are indicated tentatively for trial on some soils.

Soil structure is a fundamental consideration in assessing the value of soil-management practices, including irrigation. Soils with good structure are stated to contain a high volume of both air and water, and to supply the plant with moisture for longer intervals between irrigations and to be better aerated at field capacity shortly after irrigation.

The short discussion on replanting and rejuvenation concludes with the statement that "the removal of the cause of unhealthiness—chiefly excess soil moisture—is the all-important aim in attacking the problem of citrus decline".

Book Review

FOREST TREE SEED OF THE NORTH TEMPERATE REGIONS,

by H. I. Baldwin.

(Pp. xvi + 240. *Chronica Botanica Co., Waltham, Mass., U.S.A.* Price 4.75 dollars.)

A thorough knowledge of the nature and behaviour of tree seeds is of fundamental importance to all engaged in the propagation of young plants. Such knowledge also is necessary for the successful control of forestry operations based on natural reproduction. Both forester and nurseryman will, therefore, welcome a book in which the widely scattered literature on the subject is summarized and the more important references are given. The author states that the book is a compilation of selected material designed to suggest lines of approach rather than to be a truly comprehensive reference. The subject, however, has been very thoroughly treated.

The opening chapters deal with the structure and development of tree seed and the general factors affecting production. The author stresses the importance of the origin of seed in influencing the subsequent development of the plants grown therefrom. Methods of seed collection are given, and a further chapter deals with extraction and cleaning. Storage and longevity are discussed, and the biotic enemies of seeds reviewed. The problems of germination naturally receives considerable attention, and a section is devoted to the chemistry of seeds. Hastening of germination by artificial means is discussed. An interesting chapter deals with methods of evaluating the quality of seed without germination tests. At the end of each chapter is given a list of references which should prove useful to anyone in search of more detailed information.

Most of the tree species mentioned are American and European, and many are not commonly grown in Australia, although a proportion are quite familiar to nurserymen and foresters in this country. The seeds of many Australian trees present rather special problems and we have little exact knowledge concerning their behaviour. Germination is often erratic and in some cases secured only with great difficulty. The problems of our tree seeds must eventually receive really serious attention and the general lines of investigation indicated in Dr. Baldwin's book should prove extremely helpful to workers in this field. The material given in the book is very clearly set out into sections and should be readily comprehended, not only by the technical man, but by all interested in the general question of propagation of trees from seed.

R. H. ANDERSON.

Correspondence

Agricultural Education for a Rural Philosophy.

The existing organization of agricultural education in the Australian States must take account of basic philosophical principles and vision. Enlightened vocational training in agriculture is necessary if we are to preserve the land from which our future income is in the main to be drawn.

Economists hold little faith in the persistence of the development of heavy industry in this country after the war. The twenty years following the war will see the rehabilitation of agricultural society and a consequent acceleration of primary production all over the world. Australia, in particular, will benefit from this boom, providing we become alive in time to the possibilities before us.

The organization and development of District War Agricultural Committees point significantly to future trends. Carefully nurtured and unselfishly administered, they will provide production and marketing machinery running smoothly enough to carry the burden of social rehabilitation. But they are not enough. The imposition of external control cannot of itself guarantee acceptance. No seed may flourish but on prepared ground.

It is the function of education to prepare the ground. The aim is threefold. Those who will farm the land must learn how to produce as much as possible from the smallest area possible, with the minimum expenditure of money and labour. There must be developed a solid foundation for an outlook on farming which will lead farmers to see themselves as guardians of the soil. Thirdly, they must be given the opportunity of acquiring a general culture broad enough to enable them to enjoy active participation in the maintenance of rural populations and a healthy state of society. All men are at present preoccupied with the first of these. Most have no quarrel with attempts to make two blades of grass grow where one grew before. But what shall it profit us if we are confronted with an impoverished, depleted soil wherein to sow our seed?

The problem, a very real one, comprises the two cardinal errors of soil depletion and soil erosion. The functions of information services may well overthrow the first, provided the rural people can adopt the broad, unselfish view that they are keepers of the soil, husbandmen dedicated to the good management of their lands. The emphasis appears to be not so much on the shifting from soil-depleting to soil-conserving crops, but rather on the use of enlightened farming practices. Their adoption would go far towards the conquest of soil erosion. This demon has been seen gnawing at the spade's depth of soil which keeps the nation alive. Hillsides may be seen robbed of trees, planted with bananas yielding one or two crops and then abandoned to the ravages of flood. But few have had a bird's eye view of this sort of thing all along the Queensland coast. Were you to make a journey by plane from Brisbane to Cairns at the height of the wet season you would see the discoloured waters of every coastal stream for miles out to sea. Were there no tide rips to scour out channels, you would stand aghast at the huge sand and silt banks that would block the mouths of the rivers.

The problem of soil erosion occupied the minds of Chinese philosophers two thousand years ago. The evil effects of soil erosion can be seen today in the numerous ghost towns and hamlets that dot the landscapes of mid-western United States. Let us be warned in time. Exploitation of the soil must cease, conservation of that which actually constitutes Australia must be consciously and rationally sought.

That this can be done by the cultivation of the right approach on the part of our farming community is no idealistic dream. It is a very real possibility, for it depends mainly upon the erection of a basic philosophy. Are the youths of today to be deprived by their fathers of the heritage built by their fathers with toil and sweat? The new generation begs that stoicism be not strained, twisted and warped into sardonic acceptance of all the ills that nature and man can visit upon it.

The nation demands that agricultural education create a receptive mind in its student farmers. Public moneys may justifiably be spent in converting the practising farmer from utilitarianism to reasonable idealism, for the stake of the city in the land is little less important than that of the country. The farmer of today, no less than the farmer of tomorrow, should be taught to ask himself: "Is farming for me a means of making a living, or is it a way of life?"

To find in an adjusted state of mind the right answer to this question means the solution of the problem of rural emigration. The past two decades have been marked by a lamentable drift of rural populations to urban areas and industries. It is a feature of social organization which is not peculiar to this country, and one that has given rise to turbulent political activity.

The maintenance of rural population depends upon economic factors no less than philosophical. There must be security of tenure and justified faith that reasonable expenditure of effort will result in return sufficient to satisfy the needs of body and soul. In the long run, this comes back to education for agriculture, and it is a problem that may be tackled at both ends of the educational scale.

At the bottom end it is being courageously and successfully faced by most Education Departments of the Commonwealth. The extension of the present organization ought to be

marked by corresponding improvement in the future health of society. Nevertheless rural bias cannot be allowed to construct a sort of caste system in education which would force rural youth to the land and relegate urban youth to dependent industry and public service. From the ranks of the city-bred youth may come most valuable recruits; from beneath the farmer's roof may emerge the future leader of a State.

At the upper end of the scale we are not so clear-sighted. There is a lack of organized study to solve the problems of migrating rural populations. Although their existence certainly does not pass unheeded, sociological problems in agriculture are not being resolutely faced. The expenditure of public money is scarcely anywhere more justified than in appointments to study this particular one and those associated with it. The contribution thereby made towards ensuring a healthy state of society would far exceed the outlay, while the resultant net gain could not be measured only in terms of tangible wealth.

C. A. RODERICK.

Gympie High School, Qld.

Obituary

LESLIE JOHN WILSON.

It is with the deepest regret that we record the death of Mr. Leslie John Wilson, B.Sc. (Agr.), A.S.T.C., A.A.C.I., Analyst, Department of Agriculture of New South Wales, at the early age of 34 years. He was born at Lismore, and received his high school education at Wollongong, New South Wales.

In March, 1928, Wilson was appointed to the Department of Agriculture, as trainee in Agricultural Science, and in 1932 graduated in the Faculty of Agriculture, University of Sydney. In the same year he was appointed Assistant Analyst, and in 1937 Analyst, in the Chemist's Branch of the Department of Agriculture. This position he held at the time of his death. Soon after graduation he entered the Diploma Course at Sydney Technical College, for additional studies in Organic Chemistry, obtaining the Associateship of that Institution in 1938. He had a deep knowledge of chemistry and allied sciences, and was keenly interested in the application of this knowledge to the advancement of agriculture in this State.

Wilson had devoted considerable time to the study of the application of chemistry to plant protection, and at the time of his death had acquired considerable knowledge and experience in this specialized subject. He was an enthusiastic, accurate and tireless worker, no detail being too small for his attention. His pleasant disposition, gentlemanly manner and spirit of co-operation, gained for him the friendship of all who came in contact with him, whilst his optimism and courage during his long illness, won the admiration of all who knew him. His early death has robbed Agricultural Science in this State of one of its keenest workers at a time when such men can least be spared. Our sincerest sympathy is extended to his wife in her sad bereavement.

Personal Notes

Dr. J. R. A. McMillan, Principal Research Officer in Genetics in the Division of Plant Industry, C.S.I.R., has been seconded for the duration to the Department of Commerce and Agriculture, for full-time work with the Vegetable Seeds Committee.

Mr. N. H. White, Assistant Plant Pathologist in the Division of Plant Industry, C.S.I.R., has resigned to accept the position of Government Plant Pathologist in Tasmania.

Mr. F. H. Harper, of the South Australian Branch, is now engaged with the Department of Commerce and Agriculture, Melbourne.

Mr. T. T. Colquhoun has taken up duties with the Department of War Organization of Industry, Melbourne. Mr. A. T. Pugsley will assume the work of Secretary to the South Australian Branch for the remainder of the year.

Professor H. R. Seddon has been appointed to the Rationing Commission, Melbourne.

Mr. C. W. Winders has been appointed Assistant Editor of Publications, Department of Agriculture and Stock, Queensland.

Mr. H. B. Parry recently resigned from the position of Lecturer in Veterinary Medicine at Sydney University to take up an appointment with the Research Staff of Imperial Chemicals Pharmaceuticals Ltd., England.

Mr. L. C. Holmes gained the M.Agr.Sc. (Melbourne) in April last for a thesis on "Cost-of-Production Survey of Seventy-two Coastal New South Wales Dairy Farms, 1938-39". He is at present working in association with the Commonwealth Controller of Dairy Products in Sydney.

Mr. C. M. Donald is now Commonwealth Executive Officer for War Agricultural Committees.

Dr. H. J. Hynes has returned to the New South Wales Department of Agriculture from the Manpower Directorate and has been appointed to the position of Acting Chief of the Division of Marketing and Economics.

